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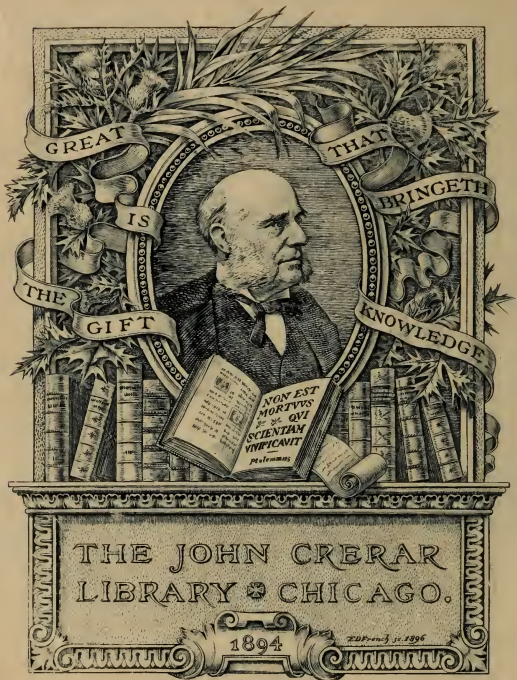
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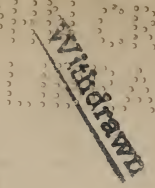

CLARK UNIVERSITY,

WORCESTER, MASS.

First Official Announcement.

MAY 23, 1889.

HARVARD MED. LIBRARY

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* DIED OCTOBER 12, 1888.

CLARK UNIVERSITY.

First Official Announcement.

The Founder.

Clark University was founded by the munificence of a native of Worcester County, whose plans, conceived more than twenty years ago, have gradually grown with his fortune. His affairs have been so arranged as to allow long intervals for travel and study. During eight years thus spent, the leading foreign institutions of learning, old and new, were visited, and their records gathered and read. These studies centered about the means by which the highest culture of one generation is best transmitted to the ablest youths of the next, and especially about the external conditions most favorable for increasing the sum of human knowledge. To the improvement of these means and the enlargement of these conditions, the new University will be devoted.

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His Desire.

It is the strong and express desire of the founder that the highest possible academic standards be here forever maintained; that special opportunities and inducements be offered to research; that to this end the instructors be not over-burdened with teaching or examinations; that all available experience, both of older countries and our own, be freely utilized, and that new measures, and even innovations, if really helpful to the highest needs of modern science and culture, be no less freely adopted; in fine, that the great opportunities of a new foundation in this land and age be diligently explored and improved.

He has chosen Worcester as the seat of the new foundation after mature deliberation—first;

Because its location is central among the best colleges of the East, and by supplementing rather than duplicating their work, he hopes to advance all their interests and to secure their good will and active support, that, together, further steps may be taken in the development of superior education in New England; and secondly;

Because he believes the culture of this city will ensure that enlightened public opinion indispensable in maintaining these educational

standards at their highest; and that its wealth will ensure the perpetual increase of revenue required by the rapid progress of science.

The Board of Trustees.

As the first positive step towards the realization of these long-formed plans, Mr. CLARK invited the following gentlemen to constitute with himself a Board of Trustees:

STEPHEN SALISBURY,

A. B., Harvard, 1856; Universities of Paris and Berlin, 1856–58; Harvard Law School, 1859–61; President Antiquarian Society since 1887.

CHARLES DEVENS,

A. B., Harvard, 1838; Harvard Law School, 1840; Major-General, 1863; Judge of Supreme Court, 1857; United States Attorney General, 1877–81; LL.D., Columbia and Harvard. 1877; Judge Supreme Court since 1881.

GEORGE F. HOAR,

A. B., Harvard, 1846; Harvard Law School, 1849; United States House of Representatives. 1868–76; United States Senate since 1876; LL.D., William and Mary, Amherst, Harvard and Yale.

WILLIAM W. RICE,

A. B., Bowdoin, 1846; admitted to Bar, 1854; United States House of Representatives, 1876–86; LL.D., Bowdoin, 1886.

*JOSEPH SARGENT,

A. B., Harvard, 1834; M. D., Harvard, 1837; London and Paris Hospitals, 1838–40,

* Died October 12, 1888.

JOHN D. WASHBURN,

A. B., Harvard, 1853; Harvard Law School, 1856; Representative, 1876–9; State Senate, 1887; United States Minister to Switzerland, 1889.

FRANK P. GOULDING,

A. B., Dartmouth, 1863; Harvard Law School, 1866; City Solicitor since 1881.

GEORGE SWAN,

A. B., Amherst, 1847; admitted to Bar, 1851; Member of Worcester School Board since 1879; Chairman of High School Committee.

A charter was granted early in 1887. Land and other property that had been before secured by the founder was transferred to the Board, and the erection of a central building was begun.

The President and his Duties.

In the Spring of 1888, G. STANLEY HALL, then a professor at the Johns Hopkins University, was invited to the presidency. The official letter conveying this invitation contained the following well-considered and significant expression of the spirit animating the Trustees:

"They desire to impose on you no trammels; they have no friends for whom they wish to provide at the expense of the interests of the institution; no pet theories to press upon you in derogation of your judgment; no sectarian

tests to apply; no guarantees to require save such as are implied by your acceptance of this trust. Their single desire is to fit men for the highest duties of life, and to that end, that this institution, in whatever branches of sound learning it may find itself engaged, may be a leader and a light."

The President was at once granted one year's leave of absence, with full salary, to visit universities in Europe. This year was diligently improved and a report of its work will be made later.

The duties of this office have been thus defined by the Trustees, May 23, 1889.

The President of the University shall consult frequently with the Trustees on all matters which concern the welfare of the University, and attend the meetings of the Board. He shall confer with each instructor concerning the development of his department, determine the duties and authority of each, and preside at the meetings of the faculty. He shall be the authorized medium of communication between the Board of Trustees and the officers of instruction, individually and collectively, in all matters involving the administration of the University. The enactments of the Board concerning instructors and their work, and all requests, complaints and proposals from the Faculty to the Trustees, shall be made known through him. He shall exercise or provide such superintendence over buildings, apparatus, books and other

property as will secure their protection and appropriate use. Expenditures must not be ordered by any instructor of the University without his previous consent, or the express authority of the Board.

Professors and Special Departments.

The plans of the University have now so far progressed that work will begin, in October next, in MATHEMATICS, PHYSICS, CHEMISTRY, BIOLOGY and PSYCHOLOGY.

These departments are provisionally arranged below in the order, not of prominence or completeness with which they will be organized at the opening, but only in the order of fullness with which announcements are now ready.

PSYCHOLOGY.

The President of the University has been appointed temporary professor of Psychology, and will continue, so far as other engagements will permit, to direct the work of this department as formerly at the Johns Hopkins University. By instruction or seminaries, or by careful personal conference and guidance to the best literature, and with the aid of Dr. SANFORD, attention will be directed to the following topics:

The general properties of the nervous substances; the psycho-physiology of each of the special senses and their defects; the perception of time and space; the time-sense; the psycho-physic law; mental images (morbid and normal) and their associations; the leading topics in the psychology of insanity, especially aphasia, illusions and hallucinations, melancholia, neurasthenia, epilepsy, hysteria, mania and paralysis; instinct; the psychology of language; myth, custom and belief anthropologically considered; hypnotism, and the psychological side of the history of philosophy, especially the Greek, German and English systems.

Dr. HALL will also direct the work of a few students of class III (below) in the history, methods and organization of education, elementary, intermediate and superior. On these topics he will give a special course of lectures during a part of the year.

Opportunities in psychology will be supplemented by work in the biological department and especially by that of Dr. DONALDSON. A well equipped laboratory of apparatus for research in the various departments of experimental psychology will also be opened in October.

Opportunities for prompt publication of meri-

torious investigations, together with digests of current literature in this department will be found in THE AMERICAN JOURNAL OF PSYCHOLOGY, which is published under the editorial care of Dr. HALL.

HENRY H. DONALDSON has been appointed assistant professor of Neurology. Dr. DONALDSON graduated from Yale College in 1879. After spending a year at the Sheffield Scientific School and another at the College of Physicians and Surgeons in New York City, he was appointed a fellow of Johns Hopkins University for two years, receiving the degree of Doctor of Philosophy there in 1885. A year and a half was then spent in Europe, chiefly with Professors Gudden at Munich, Forel at Zurich, and Golgi at Turin, and on returning he was appointed associate in psychology in the Johns Hopkins University.

Dr. Donaldson is author of the following researches: "On the Detection and determination of Arsenic in Organic Matter." (Am. Chemical Jour. Vol. II, No. 4.) "The Influence of Digitaline on the work of the Heart and on the flow through the Blood-vessels. (Jour. of Physiology, Vol. IX, No. 2. "Motor Sensations of the Skin." (Mind No. XL.) "On the Temperature-Sense." (Mind No. XXXIX.) "On the Relation of Neurology to Psychology." (Am. Journal of Psychology, Vol. I, 1888.

Dr. DONALDSON will give instruction in the finer anatomy of the central nervous system in

man, in the histology of the sense-organs in the vertebrate series and the localization of function in the brain, together with such other topics as may serve to facilitate study in these lines.

Lectures, laboratory work, conferences &c., will be offered.

Those desiring further information concerning leading works of reference, or the equipment of the laboratory, can address Dr. DONALDSON during the summer at Worcester.

EDMUND CLARK SANFORD, who has been appointed instructor in Psychology, graduated from the University of California in 1883. He has since spent four years at the Johns Hopkins University, where he was appointed fellow in psychology in 1887, and received the degree of Doctor of Philosophy the following year. The past academic year has been spent as instructor in the undergraduate department of the Johns Hopkins University, and in editing, under Dr. HALL'S supervision, THE AMERICAN JOURNAL OF PSYCHOLOGY.

Dr. Sanford is author of the following original studies: "The writings of Laura Bridgman," two articles in the Overland Monthly, 1886-7. "The Relative Legibility of the Small Letters." (Am. Jour. of Psy., May, 1888.) "Personal Equation," three articles in the Am. Jour. of Psy., Nov. 1888; Feb. and May 1889.

Dr. SANFORD will give the two following special courses:

First half year: the Physiological Psychology of Vision; monocular vision, color perception, contrast, etc.; binocular vision, stereoscopy, and the horopter, perception of space, nativism and empiricism. Chief authorities, Helmholtz, Hering, Wundt. The aim will be to demonstrate all the important experiments mentioned in the course, with suitable apparatus.

Second half year: the Application of Time-Measurements to Psychology; simple and complicated reaction-times, personal equation, association-times, and time-sense.

Dr. SANFORD will also assist Professor HALL in the work of instruction and in the direction of the psycho-physic laboratory, seminary, etc.

It is hoped that fuller opportunities for the study of historical philosophy, logic and ethics may eventually be offered.

The work of the Psychological department is intended for the following classes of students: those who desire to teach philosophy in any or all of its departments: physicians or medical students who wish to become specialists in the treatment of insanity or of diseases with nervous complications; those who desire to study educa-

tion professionally (and who are advised to give most of their energy to psychology, which is its chief scientific basis, pedagogy being a field of applied psychology).

Some of the special topics into which the work above naturally falls can be attended as a special course by students of other departments. Thus students of biology or pathology may follow the histological course of Dr. DONALDSON; students of classics may follow the course in Greek philosophy; of morphology, the lectures on instinct; of astronomy, the lectures on reaction-time and the personal equation.

BIOLOGY.

In this department WARREN P. LOMBARD was appointed assistant professor of Physiology in August, 1888.

Dr. LOMBARD graduated from Harvard College in 1878, and from Harvard Medical School in 1881. In 1881-2 he was prosector and lecturer in the College of Physicians and Surgeons in New York City, and for the next three years, 1882-5, attended lectures and was engaged in research work in Germany, chiefly in the laboratory of Professor Ludwig, in Leipsic. The next three years were devoted to research and to the duties of lecturer and assistant in physiology

at the College of Physicians and Surgeons and elsewhere. The present year is being spent in the laboratories of Professors Dastre and Darsonval of Paris, Professor Mosso of Turin and elsewhere.

Dr. Lombard is the author of the following researches in his department: Beiträge zur Theorie der Wärmempfindung. Vorläufige Mittheilung (Centralb f. d. Med. Wis. No. 32, 1883.) "Die raümliche und zeitliche Aufeinanderfolge reflectorisch contrahirter Muskeln." (Arch. f., Anat. u., Physiol. 1885. p. 408.) "The Variations of the Normal Knee Jerk." (Am. Jour. of Psychol., Oct. 1887.) "The Influence of Temperature on Voluntary Muscular Contraction in Man." (March, 1889.)

Work in this department will be conducted with the aid of lectures, laboratory, conferences, etc., and will cover the physiology of digestion, secretion, respiration, circulation, the nerves, muscles and senses. The laboratory will be well furnished with instruments and other appliances for investigation in each of these special fields.

A more detailed announcement of Dr. LOMBARD'S work will soon be made.

F. MALL has been appointed adjunct professor of anatomy. Dr. MALL graduated from the University of Michigan in 1883, where he received the degree of M. D. He studied one year with Professor Kuhne at Heidelberg, and two years

with Professors Weigert, His and Ludwig in the University of Leipsic. Since 1886 he has been, successively, fellow, instructor and associate in pathology, in the Johns Hopkins University.

Dr. Mall is the author of the following researches, among others, in his department: "Entwickelung der Branchial bogen und Spalten des Hünschens. His und Braüne, Archiv. 1887. Blut und Lymphwege im Dünndarme des Hundes. Abhandl. der Säch. Ges. d. Wiss., Bd. XIV. "Development of the Ear of the Chick." Studies from the Biolog. Lab., J. H. U., 1888. "The Bronchial Clefts of the Dog." Studies from the Biolog. Lab., J. H. U., 1888. "Reticulated and Yellow Elastic Tissues." Anatomischer Anzeiger, 1888.

Dr. MALL will offer two courses, one in histology, and one in vertebrate embryology. Each of these may be divided into two courses, one theoretical and practical for beginners, three times a week, in the afternoon, and one consisting of laboratory work (9 A. M. to 5 P. M.) for advanced students.

Journals and apparatus will be ready in October.

PHYSICS.

ALBERT A. MICHELSON has been appointed acting professor of Physics. DR. MICHELSON graduated at the United States Naval Academy in 1873, where he afterwards served as instructor in physics and chemistry for four years. He was later attached to the Nautical Almanac

office, in Washington. For two years, beginning in 1880, he worked in Europe under Helmholtz, Quincke, Mascart and Corun. On returning, he resigned his commission of master (now called lieutenant) in the navy, and became professor of physics in the Case School of Science, Cleveland, Ohio, where he has since remained. In 1888 he was awarded the Rumford medals for his researches on the velocity of light. Dr. MICHELSON is a member of the American Academy of Science, corresponding member of the British Association, Vice-President of the American Association for Advancement of Science, &c.

The following are the titles of some of his Memoirs: "Experimental Determination of the Velocity of Light." I (Proc. A. A. A. S. 1879.) "Experimental Determination of the Velocity of Light." II (Proc. A. A. A. S. 1880.) "A Method for Determining the Rate of Tuning Forks." (Am. Journal, January, 1883.) "Experimental Determination of the Velocity of Light." (Astr. Papers of the Nautical Almanac, Vol. II.) "Velocity of Light in Carbon Disulphide and Velocity of Red and Blue Light in same." (Ibid. Vol. II.) "The Relative Motion of the Earth and the Luminiferous Ether." (Am. Journal of Science, August, 1881.) "A New Sensitive Thermometer." (Journal de Physique, 1882.) "Interference Phenomena in a New Form of Refractometer." (Am. Journal, May, 1882.) "M. Wolf's Modifications of Foucault's Apparatus for Measuring the Velocity of Light." (Nature, May 7, 1885.) "Influence of Motion of the Medium on the Velocity of Light." (Am. Jour., May, 1886.) "On the Relative Motion of the Earth and the Luminiferous Ether." (Phil. Mag., November 1887.) "On a Method for Making the Wave Length of Sodium Light, the Absolute and Practical Standard of Length." (Am. Jour. December, 1887.) "On the

Feasibility of Establishment of a Light Wave as the Ultimate Standard of Length." (Not yet published)

Professor MICHELSON will give a course of illustrated and experimental lectures in physics, extending through two years. These will treat the chief topics in this department, and will be sufficiently advanced for students intending to make physics a specialty, and will be interspersed by examinations and conferences.

This course will be supplemented by a series of lectures or readings in theoretical optics, electricity and magnetism, or in thermodynamics of a more informal nature. Students with a fair knowledge of integral and differential calculus will have no difficulty in following this course.

A graded course of laboratory instruction will be offered for practical acquaintance with special methods. Dr. MICHELSON will strive, by advice and example, to encourage a spirit of diligent investigation and original research, particularly in those intending to find their life work in this department.

This plan is subject to modification, and a fuller announcement will be made later.

CHEMISTRY.

The organization of no department will probably be more complete than this in October.

A large laboratory of about fifty rooms will be ready for occupation and the names of some of the instructors can be very soon announced. Applications of students can now be received.

MATHEMATICS.

Appliances for this department are also liberally ordered; the names of instructors will soon be announced.

The organization of all of the above and of other departments will be gradual, and the foundation-period of the University will cover some years.

Apparatus is being extensively ordered of the best makers in this country and in Europe, chiefly from those who devote themselves to the special class of apparatus in which they excel.

The instructors in each department will make timely provision for all their needs, and are also requested to furnish lists of desired books and periodicals.

Methods.

Besides field work, excursions to institutions public and private, coaching and cram-classes, examinations, conferences and other modes by which knowledge now seems best imparted and retained, the following educational methods will probably be prominent:

Seminaries. These are stated, perhaps weekly, meetings, often in a department library, for joint, systematic, but conversational work, under the personal direction of the professor, in some special chapter of his subject. Here the results of individual reading are reported for the benefit of all; views are freely criticised; new inquiries, methods, comparisons, standpoints, etc., suggested. From the mutual stimulus thus given many important works have proceeded, and the efficiency of universities, especially in Germany where seminaries were first generally introduced, has been greatly increased.

Laboratory Work. For beginners this was from the first the best of all forms of apprenticeship, bringing student and professor to a far closer and mutually stimulating relation. Here the manipulation of apparatus is learned, each well-chosen piece of which is an obvious epitome of long lines of research, processes are criticised, results obtained by other investigators are tested, methods are discussed and perfected. The modern laboratory has thus become an unexcelled school of logical mental discipline, from which is developed, as its best product, that rare independence in research which is the consummation of scientific culture.

Lectures. The Trustees desire that each instructor, of however few students, should prepare and deliver regular lectures, with diagrams, illustrative apparatus and references to standard text books, and the best current literature upon each topic. Advanced students and instructors will also be encouraged to supplement the work of the professors by giving special lectures and courses. Public lectures will from time to time be given.

Classes of Students.

The following classes of students will be admitted:

I. *Independent Students:*

This class will include those who have already taken the doctorate or other academic degrees in this country or abroad, and others of sufficient training who have time that may be devoted to particular lines of study or research.

For competent men of this class, individual arrangements may be made, and an independent room, and even special apparatus and books, provided that they may pursue their investigations, either alone or with the aid and counsel of the instructors, to the best advantage.

Conditions under which a few of the most advanced students of this class can be granted the *venia docendi*, as lecturers or docents, are under careful consideration.

It is hoped that some of the permanent instructors of the University may be recruited from this class.

It is probable that a few of these mature students can be received, not only in the five departments named above, but in others soon to be organized, and in the development of which they may co-operate.

II. *Candidates for the Degree of Doctor of Philosophy.*

Those qualifying for this degree will be matriculated early in the fall, after suitable tests, which will also aid in determining when they can be admitted to the final examination.

The full course provided for this class of students will be three years, but admission to advanced standing at the outset is possible, and those found to be qualified may be allowed to take the doctor's examination in two years, or even one.

It is to the needs of these students that the lectures, seminaries, laboratories and collections

of books and apparatus will be especially shaped, and no pains will be spared to afford them every needed stimulus and opportunity. It is for them that the fellowships and scholarships are primarily intended, although any of these honors may be awarded to students in classes I or III.

III. *Special students not candidates for a degree.*

This class includes those who may desire to devote themselves exclusively to one or more of the special branches—mathematics, physics, chemistry, biology or psychology—but who do not care to matriculate or become candidates for a degree.

These students, provided they satisfy the heads of departments of their training and competency in one subject, in which they must be advanced (although they may be less so, or even beginners, in other subjects) may be allowed entire freedom in their choice and combination of studies, and, as special students, may enjoy all the privileges of the University.

IV. *Medical Students.*

The University offers special facilities in those fundamental disciplines upon which the study of medicine in all its departments now rests.

Thus, students of sufficient preliminary training can be admitted in the departments of chemistry, biology, anatomy, physiology and neurology, and receive here the purely scientific part of a medical education.

V. *Preliminary candidates or undergraduates.*

Non-university students of less special, or less advanced standing than the above four classes, who are nearly, but not quite, qualified to become candidates for the degree of doctor of philosophy, may also be received.

Students of this class must for the present have completed the work of the first three, or at least of the first two, years of a regular undergraduate course in a college of good standing, or the equivalent thereof. They must satisfy the authorities of the University that they can proceed to the degree of A. B. in one year and contemplate advancing to a higher degree. The privileges and status of these students will be more fully defined later. They may be elected to scholarships, but not to fellowships.

Fellowships and Scholarships.

To no form of educational gift or bequest have probably so many people contributed as to

the various forms of individual aid to meritorious students.

Under the names of bursaries, stipends, exhibitions, prizes, benefices, etc., as well as of scholarships and fellowships, the revenues of foundations established by and bearing the names of sometimes hundreds of donors in a single university, are annually distributed.

Sometimes these funds were given by men or women themselves not far removed from need, and are appointed to furnish a student with firewood, a room, a bed, one daily meal, or a coat each year, etc., and sometimes yielding one or two thousand dollars to a single holder. Often many students were provided by a single donor, and some of these European foundations, even the smallest, are centuries old, so sacredly are they guarded, and others are even now being established.

The more advanced the education the more such aids are needed, and the more numerous and substantial do they in fact become in Europe.

So great is now the need of bringing the best intellects to fullest maturity, and so increasingly necessary for the highest scientific attainment are now the leisure, tranquillity, books and appara-

tus thus best supplied, that the demand is strong for still more and greater aids of this kind for advanced and competent students.

Several of the wisest governments in Europe, recognizing that the modern world and its rulers are ruled by experts thus best trained, vie with private munificence in supplying such aids.

With a deep sense of the peculiar needs of our country in this respect, the founder of this University and his wife have provided such opportunity and incentive here as follows :

In addition to all previous gifts of the donor, and apart from the permanent funds of the University, full tuition of two hundred dollars each for thirty meritorious students will be paid into the treasury. For eight of these students, thus freed from tuition, Mr. Clark has also established fellowships yielding each holder four hundred dollars per annum, and eight more fellowships yielding each holder two hundred dollars per annum. These, with eight free scholarships as above provided, will be known as the JONAS G. CLARK SCHOLARSHIPS and FELLOWSHIPS respectively.

Mrs. Clark has established two fellowships yielding four hundred dollars each, and two fel-

lowships yielding two hundred dollars each per annum. These, with the two remaining scholarships, will be known as the Mrs. JONAS G. CLARK FELLOWSHIPS and SCHOLARSHIPS respectively.

These six latter are especially provided for the department of psychology, while the 24 presented by Mr. Clark are to be distributed among the other four departments at the discretion of the president and faculty.

The founder and his wife unite with the trustees and president in inviting sympathy and practical co-operation in the multiplication of such aids, large or small, temporary or permanent, here at the outset.

Both scholarships and fellowships are open only to students in one or more of the five departments announced, and are renewable annually. They are designed to encourage promising young men, graduates of colleges and others who have developed a preference for particular lines of study in which they desire to attain still further proficiency.

While intended to remove pecuniary hindrances in the way of such students, both scholarships and fellowships are primarily honors, awarded without reference to pecuniary needs. Thus, those desiring to do so may relinquish

the emolument and retain the title of scholar and fellow.

Residence in Worcester, during University sessions, and work under the general direction of the heads of departments is required. Those appointed to these honors must, unless by special arrangement, be under the age of thirty-five, and must devote themselves to scientific or liberal, instead of to industrial or professional studies. They should work in a spirit of hearty co-operation with their instructors and of genuine devotion to science.

Applications can now be received, and may be accompanied by diplomas, testimonials, and a brief statement of the course of study. Those applying for fellowships, especially of the first class, should also, if possible, submit some specimen of their work, in writing or in print.

Appointments will be made from time to time during the coming summer and fall. Private announcements will be sent to successful candidates, and no publicity will be given to the names of those not appointed.

Location.

The University is situated in Worcester, the third city of New England in size, with 80,000

inhabitants. It is one hour westward from Boston by rail, and five hours from New York city. Central among the best New England colleges, the location is most favorably chosen for attempting the next step in the higher university development of the country.

Worcester is also the seat of the following institutions of an educational character.

THE AMERICAN ANTIQUARIAN SOCIETY, an institution of national character and repute, organized in 1812, with a library of 85,000 volumes, possessing funds and collections, and issuing publications of its own.

THE WORCESTER FREE PUBLIC LIBRARY, containing about 75,000 volumes and receiving about 250 periodicals.

THE WORCESTER POLYTECHNICAL INSTITUTE, incorporated in 1865, with three large and well appointed buildings, fifteen instructors and a three years' course mainly in the sciences and their application to the practical arts.

THE WORCESTER LYCEUM AND NATURAL HISTORY ASSOCIATION, incorporated in 1866, and containing extensive local collections.

THE COLLEGE OF THE HOLY CROSS, a Catholic

institution of high grade, incorporated in 1865, and with a corps of fifteen instructors.

In addition to these may be mentioned a law library of 12,000 volumes; a medical library of 8000 volumes; a State Normal School with a two years' course, eight instructors and about two hundred students; one high school; the Highland Military Academy, founded in 1858, with seven instructors; the Worcester Academy, a private institution, founded in 1874; and several other libraries, societies and educational institutions.

The University is located in the western part of the city about a mile from the central station.

Before the charter was applied for, in January, 1887, about nine acres of land had been bought, and to this single lot other tracts near by have since been added.

Buildings.

A plain, substantial and well-appointed central building, 204 by 114 feet, four stories high, and with superior facilities for heating, lighting and ventilation, has been constructed of brick and granite, and finished throughout in oak.

A chemical laboratory, designed after consulting many experts and plans of recent European buildings, and containing about 50 rooms, is nearly completed.

The foundations of a still larger department building are laid.

Notices.

The work of instruction will begin in the five departments above announced, on Wednesday, Oct. 2, 1889.

The charge for tuition, giving all the privileges of the University, but not covering laboratory fees, will be $200 per annum.

Board and lodging can be obtained near the University at very moderate rates.

Further announcements concerning instructors courses, matriculation, examinations, fellowships, etc., will be made from time to time during the summer.

Intending students will, so far as possible, be informed upon any of these or other points, in advance of official announcement, upon addressing the Clerk.

G. Stanley Hall,

President of Clark University.

Press of Charles R. Stobbs, Worcester.

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CLARK UNIVERSITY,

WORCESTER, MASS.

REGISTER

AND

Second Official Announcement.

MAY, 1890.

TRUSTEES.

President, - - JONAS G. CLARK.

Vice-Presidents, - - { CHARLES DEVENS. / GEORGE F. HOAR. / WILLIAM W. RICE.

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Jonas G. Clark.
Stephen Salisbury.

BY-LAWS.

Jonas G. Clark.
William W. Rice.
John D. Washburn.
Stephen Salisbury.
George Swan.

James P. Hamilton, - - - Cashier.

CLARK UNIVERSITY.

REGISTER

AND

Second Official Announcement.

WORCESTER, MASS.:
PUBLISHED FOR THE UNIVERSITY.
May, 1890.

CALENDAR: 1890—'91.

1890.

JUNE 17. Tuesday. Present academic year ends.

OCT. 1. Wednesday. Second academic year begins.

DEC. 24. 1891. JAN. 2. } Christmas Recess.

Date of the Spring Recess and close of next academic year to be determined later.

APPOINTMENTS.

STAFF.

G. STANLEY HALL, PH. D. LL. D., President of the University.
94 Woodland St.

A. B., Williams College, 1867 and A. M., 1870; Ph. D. Harvard University, 1878; Lecturer in Harvard and Williams Colleges, 1880–81; Professor of Psychology Johns Hopkins University, 1881–88; LL. D., University of Michigan, 1888; and Williams College, 1889.

ALBERT A. MICHELSON, PH. D., Professor of Physics.
96 Woodland St.

Midshipman U. S. Naval Academy, 1873; Instructor in Physics and Chemistry, U. S. Naval Academy, 1873–77; Nautical Almanac Office, Washington, 1877–79; Professor of Physics, Case School of Science, Cleveland, O., 1883–89; Honorary Ph. D., Western Reserve University, 1886; and Stevens Institute, 1887; Rumford Medals, 1888; Member of the National Academy, American Academy of Science, Corresponding Member of the British Association, and Member of American Association for the Advancement of Science.

WILLIAM E. STORY, PH. D., Professor of Mathematics.
14 May St.

A. B., Harvard University, 1871; Ph. D., Leipzig, 1875; Tutor of Mathematics, Harvard University, 1875–76; Associate, Assistant Professor, and Associate Professor of Mathematics, Johns Hopkins University, 1876–89; Member of the London Mathematical Society, Corresponding Member of the Natural Society of the Natural and Mathematical Sciences of Cherbourg; Resident Fellow of the American Academy of Arts and Sciences.

C. O. WHITMAN, PH. D., Professor of Invertebrate Morphology.
936 Main St.

A. B., Bowdoin, 1868; Principal of Westford Academy, and Master of English High School, Boston, 1869–75; Ph. D., Leipzig, 1878; Fellow of Johns Hopkins University, 1879; Professor of Zoology, Imperial University of Japan, 1880–81; Naples Zoological Station, 1882; Director of the Allis Lake Laboratory, 1886–89; Director of Marine Biological Laboratory, Woods Holl, Mass., since 1887.

HENRY H. DONALDSON, PH. D., Assistant Professor of Neurology. 873 Main Street.

A. B., Yale, 1879; Sheffield Scientific School, 1880; College of Physicians and Surgeons, New York, 1881; Fellow of Johns Hopkins University, 1883–85; Ph. D., Johns Hopkins University, 1885; Associate in Psychology, Johns Hopkins University, 1887–89.

WARREN P. LOMBARD, M. D., Assistant Professor of Physiology. 17 Hammond Street.

A. B., Harvard, 1878; M. D., Harvard Medical School, 1881; Leipzig, '82–85; Assistant in Physiology, College of Physicians and Surgeons, New York, 1888.

JOHN U. NEF, PH. D., Assistant Professor of Chemistry. 5 Grout Court.

A. B., with honors in Chemistry, Harvard, 1884; Kirkland Fellow Harvard University, 1884–6; Ph. D., Münich, 1886; Professor of Chemistry and Director of the Chemical Laboratory Purdue University, Lafayette, Ind., 1887–9.

FRANKLIN P. MALL, M. D., Adjunct Professor of Anatomy. 862 Main Street.

M. D., University of Michigan, 1883; University of Heidelberg, 1884; University of Leipzig, 1885–86; Fellow, Instructor, and Associate in Pathology, Johns Hopkins University, 1886–89.

OSKAR BOLZA, PH. D., Associate in Mathematics. 978 Main Street.

Ph. D., Göttingen, 1886; Reader in Mathematics, Johns Hopkins University, 1887–89.

EDMUND C. SANFORD, PH. D., Instructor in Psychology. 21 Oread Place.

A. B., University of California, 1883; Fellow of Johns Hopkins University, 1887; Ph. D., Johns Hopkins University 1888; Instructor in Psychology Johns Hopkins University, 1888.

DOCENTS.

FRANZ BOAS, PH. D., Docent in Anthropology. 210 Beacon Street.

Ph. D., Kiel 1881; Member of Expedition to the arctic regions 1883–4; Docent of University of Berlin, 1885. Anthropological Researches in British Columbia and Alaska, 1886–87; and in the same territory, under the auspices of the British Association for the Advancement of Science, 1888–89.

B. C. BURT, B. A., M. A., Docent in Philosophy. 80 Woodland Street.

A. B., Michigan University, 1875; Professor Indiana State Normal School,

1875-78; and M. A., 1879; Fellow in Philosophy Johns Hopkins University, 1881; and Fellow by courtesy, 1837; Assistant Professor, Michigan University, 1881-87.

ALFRED COOK, PH. D., Docent in Philosophy.
978 Main Street.

A. B., Northwestern University 1877; Ph. D., University of Halle, 1886; Fellow by courtesy in Johns Hopkins University, 1887; Superintendent of Schools, Nimauk, Ill., 1888; Associate in Philosophy, Bryn Mawr College, 1889.

MORRIS LOEB, PH. D., Docent in Physical Chemistry.
9 Maywood Street.

A. B., Harvard, 1883; PH. D., Berlin, 1887; Assistant to Professor Wolcott Gibbs, 1888-89.

ARTHUR MACDONALD, A. B., A. M., Docent in Ethics.
77 Piedmont Street.

A. B., University of Rochester, 1879; and A. M., 1883; Union Theological Seminary, 1880-83; Harvard University, 1883-85; Fellow of Johns Hopkins University, 1885; Berlin and Leipzig Universities, 1885-86; University of Paris, 1886-87; University of Zurich, 1887-88.

J. PLAYFAIR MCMURRICH, M. A., PH. D., Docent in Morphology. 881 Main Street.

A. B. University of Toronto, 1879; and Assistant in Biological Laboratory 1880-81; M. A., 1882; Professor of Biology in the Ontario Agricultural College, Guelph, Canada, 1882-84; Instructor in Osteology Johns Hopkins University, 1884-85; Ph. D., Johns Hopkins University, 1885; Professor of Biology at Haverford College, Pennsylvania, 1886-89; Member of Staff of Instruction, Marine Biological Laboratory, Woods Holl, Mass.

F. WILLIAM MUTHMANN, PH. D., Docent in Chemistry.
20 Grand Street.

Assistant in Analytical chemistry, University of Munich, 1884-86; Ph. D., Munich, 1886; Instructor in Chemistry and Crystallography, University of Munich, 1887-89.

HENRY TABER, PH. D., Docent in Mathematics.
28 Woodland Street.

A. B., Yale, (Sheffield Scientific School) 1882; Ph. D., Johns Hopkins University, 1888; and Assistant in Mathematics, Johns Hopkins University, 1888-89.

HONORARY FELLOWS.

CHARLES W. MARSH, PH. D., New York City, Honorary Fellow in Chemistry. 70 Florence Street.

Ph. B., Columbia School of mines, 1879; and Ph. D., 1882; Assistant in Chemistry, John C. Green School of Science, Princeton, N. J., 1882-85; student at Berlin 1885-87; Assistant in Chemistry, Lehigh University, South Bethlehem, Pa., 1887-89.

J. FRANCIS WILLIAMS, C. E., PH. D., Salem, N. Y., Honorary Fellow in Chemistry. 70 Florence Street.

St. Pauls School, Concord, N. H., 1880; C. E. Rensselaer, Polytechnic Institute 1883, and B. S., 1884; Ph. D., Göttingen, 1886; Student, Berlin, 1887; Director of Technical museum of the Pratt Insitute, Brooklyn, 1887–89.

FELLOWS.

HERMON C. BUMPUS, PH. B., Dorchester, Mass., Fellow in Biology. 862½ Main St.

Ph. B., Brown University, 1884, and Instructor in Zoology, 1885-6; Professor of Zoology and Geology, Olivet College, Olivet, Mich., 1886-89; Instructor marine Biological Laboratory, Woods Holl, Mass., 1890.

THOMAS H. CLARK, B. S., Worcester, Mass., Fellow in Chemistry. 14 Lancaster St.

B. S., Polytechnic Institute, Worcester, Mass., 1880; Johns Hopkins University, 1883; Assistant in Chemistry, Wesleyan University, Middletown, Conn., 1886-89.

ROLLIN A. HARRIS, PH. D., Jamestown, N. Y., Fellow in Mathematics. 1018 Main St.

Ph. B., Cornell University, 1885; Fellow 1886–87 and Ph. D., 1888.

CLIFTON F. HODGE, PH. D., Ripon Wis., Fellow in Psychology. 3 Lowell St.

A. B., Ripon College, 1882; Ph. D., Johns Hopkins University, 1889.

ALEXANDER McADIE, A. M., New York City., Fellow in Physics. 7 Shirley St.

A. B., College of the City of N. Y., 1881, and A. M., 1884; A. M., Harvard University, 1885; Jefferson Physical Laboratory, 1882–5; Physical Laboratory U. S. Signal Service, Washington, 1886-8.

FREDERICK TUCKERMAN, B. Sc., M. D., Amherst, Mass., Fellow in Anatomy. Bay State House.

B. Sc., Boston University, 1878; M. D., Harvard Medical School, 1882; Fellow of Mass. Med. Soc., 1883; Lecturer in Anatomy and Physiology, Mass. Agricultural College, 1883-86.

HENRY BENNER, M. S., Cressman, Pa., Fellow in Mathematics. 978 Main St.

B. S., West Chester (Pa.) State Normal School, 1885 and M. S., 1887; M. S., University of Michigan, 1889.

DANIEL FULCOMER, A. M., Hailey, Idaho, Fellow in Psychology. 84 Woodland St.

A. B., Western College, Iowa, 1884, and A. M., 1888.

J. F. McCULLOCH, A. B., A. M., Adrian, Mich., Fellow in Mathematics. 8 Gates St.

A. B., Adrian College 1883; Ph. B. 1884 and A. M. 1889; Assistant Professor of Mathematics Adrian College, 1885–87; Instructor in Mathematics University of Michigan 1887--88; Assistant Professor of Mathematics Adrian College 1888--89.

W. H. METZLER, A. B., Odessa, Ont., Canada, Fellow in Mathematics, 428 Park Ave.

A. B., University of Toronto 1888. Science Master, Collegiate Inst., Ingersoll, Ont., 1889.

DICKINSON S. MILLER, A. B., Philadelphia Pa., Fellow in Pyschology. 7 Shirley St.

A. B., University of Pa., 1888.

HERBERT NICHOLS, B. S., Fellow in Psychology. 70 Florence St.

B. S., Worcester Polytechnic Institute, 1871.

CHARLES K. SWARTZ, A. B., Gettysburgh, Pa., Fellow in Chemistry. 3 Lowell St.

A. B., Johns Hopkins University, 1888; Student Berlin and Heidelberg, 1888-89.

F. L. O. WADSWORTH, M. E., B. S., Cleveland, O., Fellow in Physics. 6 Castle St.

E. M., State University, Columbus, O., 1887; M. E. 1888 and B. S., 1889.

J. W. A. YOUNG, A. B., Williamsport, Pa., Fellow in Mathematics. 29 Benefit St.

A. B., Bucknell University, Lewisburg, Pa., 1887 ; Instructor in Mathematics, Bucknell Academy, 1887–88 ; Student University of Berlin, 1888–89.

ASSISTANTS.

JOHN C. CARDWELL, M. D., Brooklyn, N. Y., Assistant in Physiology. 1 Agawam St.

M. D., University City of New York, 1888; Assistant in Physiological Department of the Loomis Laboratory, New York City, 1888--89.

A. G. MAYER, M. E., Maplewood, N. J., Assistant in Physics. 9 Shirley St.

M. E., Stevens Institute, Hoboken, N. J., 1889.

V. PÄPCKE, PH. D., Assistant in Chemistry. 14 Crystal St.

Ph. D., Gottingen, 1888.

CAMILLE RIED, Boston, Mass., Instructor in Modern Languages. 84 Woodland St.

SCHOLARS.

ERNEST ALBEE, A. B., Langdon, N. H., Scholar in Psychology. 1 Agawam St.

A. B., University of Vermont 1887.

L. P. CRAVENS, A. M., Carthage, Ills., Scholar in Mathematics

A. B. Carthage College 1878 and A. M., 1879; Principal Mount Morris Academy 1880–84; Professor of Mathematics, Carthage, Ills. 1884–89; Supt. of Public Schools, Carthage, Ills. 1887–89.

W. F. DURAND, Scholar in Physics. 978 Main St.

Agricultural College, Mich.

E. A. KIRKPATRICK, B. Sc., M. Ph., Ames, Iowa, Scholar in Psychology, 84 Woodland St.

B. Sc., Iowa Agricultural College, 1887 and M. Ph., 1889.

C. A. ORR, A. B., Salem, Ohio., Scholar in Psychology.

A. B., University of Michigan, 1887; Johns Hopkins University, 1887--88, Principal High School, Salem, Ohio, 1888--89; Anthropologist Solor Eclipse Expedition, 1889--90.

JULIUS STIEGLITZ, A. M., Ph. D., New York City, Scholar in Chemistry. 14 Crystal St.

A. M. and Ph. D., University of Berlin, 1889; Gottingen, 1888.

ARTHUR J. WARNER, A. B., Marietta, Ohio, Scholar in Physics. 6 Hancock St.

A. B., Marietta College 1889.

OLIVER P. WATTS, A. B., Thomaston, Me., Scholar in Chemistry. 9 Lagrange St.

A. B., Bowdoin, 1889.

HONORARY SCHOLARS.

PURSUING SPECIAL INVESTIGATION.

WALTER CHANING, M. D., Brookline, Boston, Mass.

HOMER GAGE, M. D., Worcester, Mass. 50 Pearl St.

WILLIAM S. MILLER, M. D., Worcester, Mass. 3 Castle St.

M. D., Yale Medical School, 1889; Lecturer in Microscopical Technique Mount Holyoke College, 1887--88; Pathologist to the Worcester City Hospital.

TOSHIHIDE SHINODA, Tokio, Japan. 53 Eastern Ave.,

Graduate of the Higher Normal School, Tokio, Japan.

W. G. WATTS, Leicester, Mass. 16 Woodbine St.

ADMINISTRATION OF THE UNIVERSITY.

The Trustees are the ultimate source of authority in all matters pertaining to the University. They act collectively, through the three committees named below, and also through the President of the University.

BOARD OF TRUSTEES.

JONAS G. CLARK.

STEPHEN SALISBURY,
CHARLES DEVENS,
GEORGE F. HOAR,
WILLIAM W. RICE,
JOHN D. WASHBURN,
FRANK P. GOULDING,
GEORGE SWAN,
EDWARD COWLES.

OFFICERS.

President, - - - - JONAS G. CLARK.

Vice-Presidents, - - { CHARLES DEVENS, GEORGE F. HOAR, WILLIAM W. RICE.

Secretary, - - - - FRANK P. GOULDING.

COMMITTEES.

FINANCE.

JONAS G. CLARK, STEPHEN SALISBURY.

BUILDINGS.

JONAS G. CLARK, JOHN D. WASHBURN.

BY-LAWS.

JONAS G. CLARK,
WILLIAM W. RICE, STEPHEN SALISBURY,
JOHN D. WASHBURN, GEORGE SWAN.

President

(G. Stanley Hall).

The duties of this office were defined by the Trustees, May 23, 1889, as follows:

The President of the University shall consult frequently with the Trustees on all matters which concern the welfare of the University, and attend the meetings of the Board. He shall confer with each instructor concerning the development of his department, determine the duties and authority of each, and preside at the meetings of the faculty. He shall be the authorized medium of communication between the Board of Trustees and the officers of instuction, individually and collectively, in all matters involving the administration of the University. The enactments of the Board concerning instructors and their work, and all requests, complaints and proposals from the Faculty to the Trustees, shall be made known through him. He shall exercise or provide such superintendence over buildings, apparatus, books and other property as will secure their protection and appropriate use. Expenditures must not be ordered by any instructor of the University without his previous consent, or the express authority of the Board.

These duties were more fully defined by By-Laws enacted by the corporation, September 26, 1889.

FACULTY.

By action of the Trustees the Faculty Staff has been organized as follows:

I. University Senate.

Whose duty it is to elect Fellows and to take action upon general requirements for the doctor's degree and other promotions, and to act and advise upon matters officially submitted to them.

II. General Faculty.

Whose duty it is to consider all matters not otherwise provided for, and in which all departments of the University are alike interested.

III. The Biological Faculty.

Whose duty it is to consider in detail the requirements for admission and degrees in the departments of Biology and Psychology.

IV. The Physical-Mathematical Faculty.

Whose duty it is to consider in detail the requirements for admission and degrees in the departments of Physics, Chemistry and Mathematics.

V. The Library Committee.

To be appointed by the president, the duty of which shall be to advise concerning the arrangement, cataloguing and use of books and other matters pertaining to the library not reserved to the Trustees or otherwise provided for.

GENERAL STATEMENTS.

The University now consists of a group of five closely related departments in which all its work and that of the above Instructors, Fellows and Scholars is grouped. These departments are as follows:

I. Mathematics.

II. Physics.

III. Chemistry.

IV. Biology, including Anatomy and Physiology.

V. Psychology, including Neurology, Anthropology, Criminology and History of Philosophy.

In addition to these, modern languages are taught in a way to meet the practical needs of students in these departments.

During the year twenty-eight lecturers have given thirty-three courses with an average attendance of eight hearers to each course.

The members of the University now represent graduates of forty-eight colleges or scientific schools.

To express more explicitly the character and policy of the Institution, the Trustees have voted to approve and publish the following statement.

"As the work of the University increases, its settled policy shall be always, to first strengthen departments

already established until they are as thorough, as advanced, as special, and as efficient as possible, before proceeding to the establishment of new ones."

"When this is done and new departments are established, those shall always be chosen first which are scientifically most closely related to departments already established; that the body of sciences here represented may be kept vigorous and compact, and that the strength of the University may always rest, not upon the number of subjects, nor the breadth or length of its curriculum, but upon its thoroughness and its unity."

"This shall in no wise hinder the establishment, by other donors than the founder, of other and more independent departments if approved by the Trustees."

"While ability in teaching shall be held of great importance, the leading consideration in all engagements, reappointments and promotions shall be the quality and quantity of successful investigation."

In focusing its means and care to make each of the above departments the best possible, the University now offers an extension of the elective system to institutions, believing that if this larger option should establish a habit of inter-University migration our higher institutions would be stimulated, and that thus they may be brought to represent the higher educational needs of the country.

Admission.

Only graduate students are admitted, or those of equivalent attainments, unless in rare and special cases.

At present no entrance examinations are required, but, by testimonials, diplomas, personal interviews or written specimens of work, the authorities must be satisfied that the applicant has scholarship enough to work to advantage, and zeal and ability enough to devote himself to his chosen field. The methods of the University are too costly, and its energy and funds too precious to be spent upon men who are not promising and in earnest.

It is highly desirable, and will probably before long be required, that candidates entering any of the five departments should have, besides a knowledge of the other subjects commonly taught in colleges, a reading knowledge of French and German.

For the select students who are received, it is the purpose of the University to open all its privileges, and to supply every incentive possible in the way of books, facilities, and, above all, direct personal stimulus and instruction.

Classes of Appointees.

No clearly marked line exists between students and instructors. Fellows and scholars who have attained some degree of mastery in a special line of work give brief special courses, which are often attended by professors. This is a stimulus to the student, and both tests and exhibits his power in teaching. This, and the custom of instructors to attend each other's lectures, has added interest and efficiency to the work of the University during the year.

1.—Docents.

The highest annual appointment is that of Docent. These positions are primarily honors and are reserved for a few men whose work has already marked a distinct advance beyond the Doctorate and who wish to engage in research. They are not assistants and their relations are directly with the President of the University.

Docents may be provided with individual rooms, and special apparatus may be purchased for their work if desired and approved. They may also be equipped and sent on scientific expeditions. While they will be expected during some part of the year to deliver a limited number of lectures on some special chapter of their department, their time will be mainly reserved for study and research in a way best adapted to qualify them still more fully for academic advancement.

These positions are now official appointments. Appointees or others found worthy however may be formally invested with the *licentia docendi*, the terms of which can now be furnished on application and require a memoir or essay representing original work in their own department, but no examination. This highest formal academic honor will be strictly reserved for those of marked scientific attainment and teaching ability and so far as this diploma can have the significance of a title or degree it will be regarded by the University as a brevet collegiate Professorship.

It is believed that by the existence of such a select body of men of guaranteed scientific training, ability

and approved power to teach, the difficulties under which college trustees sometimes succumb in selecting suitable men for their professors may be diminished, and that otherwise this academic grade will aid in raising standards of academic scholarship in colleges and in encouraging scientific research here.

Good men of this class are desired by the University above all others and may be paid a salary.

II.—Candidates for the Degree of Doctor of Philosophy.

The full course provided for candidates for this degree, just from colleges, is three years and for most this period of post-graduate study will probably be necessary. Admission to advanced standing in this course however is possible at the outset or at any time, and those found qualified may be allowed to take the Doctor's examination in two years or even one. Examinations for this degree may be held at any time of the year when in the judgment of the University authorities the candidate is prepared.

For this degree the first requirement is a thesis upon an approved subject to which it must be an original contribution of value. It must be reported upon in writing by the chief Instructor in the department, printed in whole, in part, or in abstract, as the Instructor may determine, at the expense of the candidate and one hundred copies given to the University. An examination and ot course a good knowledge of French and German are also indispensable.

For the bestowal of this degree, the approbation of the Board of Trustees must in each case be obtained. They desire that the standard requirements for it be kept the highest practicable, that it be reserved for, men of superior ability and attainment only, and that its value here be never suffered to depreciate.

It is to the needs of these students that the lectures, seminaries, laboratories, collections of books, apparatus, etc., are specially shaped and no pains will be spared to afford them every needed stimulus and opportunity. It is for them that the Fellowships and Scholarships are primarily intended, although any of these honors may be awarded to others.

III.—Special Students not Candidates for a Degree.

Anyone desiring to undertake a special and approved line of research and whose attainments are such as to satisfy the requirements of the University may also be received. This class includes those who may desire to devote themselves exclusively to one or more of the special branches—mathematics, physics, chemistry, biology or psychology—but who do not care to matriculate or become candidates for a degree.

These students, provided they satisfy the heads of departments of their training and competency in one subject, in which they must be advanced (although they may be less so, or even beginners, in other subjects) may be allowed entire freedom in their choice and combination of studies, and, as special students, may enjoy all the privileges of the University.

These students may, with the approval of the President, be received for less than an entire year.

IV.—Medical Students.

The University offers special facilities in those fundamental disciplines upon which the study of medicine in all its departments now rests.

Students of sufficient preliminary training can be admitted in the departments of chemistry, biology, anatomy, physiology, neurology and anthropology, and receive here the purely scientific part of a medical education. For such students work in the above departments can be now so arranged as to be almost identical with that of the first two years of the best medical schools of the world. Facilities for clinical instruction and hospital work which commonly constitute the latter part of a medical course, are not yet offered here.

V. Preliminary Candidates.

Non-university students of less special, or less advanced standing than the above four classes, who are nearly, but not quite, qualified to become candidates for the degree of doctor of philosophy, may also be received.

Students of this class must for the present have completed the work of the first three years of a regular under-graduate course in a college of good standing, or the equivalent thereof. They must satisfy the authorities of the University of their attainments and that they

contemplate advancing to a degree higher than that of A. B. The privileges and status of these students will be more fully defined later. They may in exceptional cases be elected to Scholarships.

FELLOWSHIPS AND SCHOLARSHIPS.

To no form of educational gift or bequest have probably so many people contributed as to the various forms of individual aid to meritorious students.

Under the names of bursaries, stipends, exhibitions, prizes, benefices, etc., as well as of scholarships and fellowships, the revenues of foundations established by and bearing the names of sometimes hundreds of donors in a single university, are annually distributed.

Sometimes these funds were given by men or women themselves not far removed from need, and are appointed to furnish a student with firewood, a room, a bed, one daily meal, or a coat each year, etc., and sometimes yield one or two thousand dollars to a single holder. Often many students were provided by a single donor, and some of these European foundations, even the smallest, are centuries old, so sacredly are they guarded, and others are even now being established.

The more advanced the education the more such aids are needed, and the more numerous and substantial do they in fact become in Europe.

So great is now the need of bringing the best intellects to fullest maturity, and so increasingly necessary for the highest scientific attainment are now the leisure,

tranquility, books and apparatus thus best supplied, that the demand is strong for still more and greater aids of this kind for advanced and competent students.

Several of the wisest governments in Europe, recognizing that the modern world and its rulers are ruled by experts thus best trained, vie with private munificence in supplying such aids.

THE CLARK FELLOWSHIPS AND SCHOLARSHIPS.

With a deep sense of the peculiar needs of our country in this respect, the founder of this University and his wife in September last provided such opportunity and incentive here as follows:

In addition to all previous gifts of the donor, and apart from the permanent funds of the University, full tuition of two hundred dollars each for thirty meritorious students was paid into the treasury. For eight of these students thus freed from tuition. Mr. Clark also established eight fellowships yielding each holder four hundred dollars per annum, and eight more fellowships yielding each holder two hundred dollars per annum. These, with eight free scholarships as above provided, were known as the JONAS G. CLARK SCHOLARSHIPS and FELLOWSHIPS respectively.

Mrs. Clark established two fellowships yielding four hundred dollars each, and two fellowships yielding two hundred dollars each per annum. These, with the two remaining scholarships were known as the MRS. JONAS G. CLARK FELLOWSHIPS and SCHOLARSHIPS respectively.

These six latter were especially provided for the department of Psychology, while the twenty-four presented by Mr. Clark were to be distributed among the other four departments at the discretion of the president and faculty.

Mr. and Mrs. Clark will contribute twelve thousand dollars for Scholars, Fellows and Docents during the next academic year.

The founder of the University and his wife unite with the trustees and president in inviting sympathy and practical co-operation in the multiplication of such aids, large or small, temporary or permanent, here at the outset.

A Citizen's Fund.

In addition to this a citizen of Worcester has given a fund of $5,000, the income of which is to be used for the aid of "some one or more worthy native born citizens of the city of Worcester who may desire to avail themselves of the advantages of the institution."

The Field Fund.

Mrs. Eliza W. Field has also given $500, to be called the "John White Field Fund" the income of which is "to provide for the minor needs of a Scholar or Fellow."

Purpose and Conditions of Fellowships.

Fellowships at Clark University are intended for

young men of promise who desire to pursue post-graduate studies in order to fit themselves for intellectual careers. It is desirable, but not required, that candidates for these positions should intend to proceed to the degree of Doctor of Philosophy or to equivalent attainments. In general, those intending to represent some special branch of learning are preferred to those directly fitting themselves for one of the three learned professions although the latter are not excluded.

Applications should state the candidate's course of study and be accompanied by testimonials or diplomas, should indicate a decided preference for some special department and if possible be accompanied by some specimen of his work for the aid of the Board of Selection. Applications will be considered in June and in October and should be in the hands of the president on or before the first of these months. In special cases vacancies may be filled by appointments at any time during the year. The names of unsuccessful candidates will not be made public.

Fellows must reside in Worcester during the academic year and devote themselves to special studies under the direction of their instructors and give such evidence of progress or proficiency before the end of the year as the authorities shall require. They must co-operate in promoting order and the ends of the University, must not teach elsewhere and may be reappointed at the end of the year. Because intended primarily as honors, both Fellowships and Scholarships are awarded without

reference to pecuniary needs, so that those able and desiring to do so may relinquish the emolument and retain the title of "Scholar" or "Fellow."

Both scholarships and fellowships are open only to students in one or more of the five departments announced.

METHODS.

Beside field work, excursions to institutions public and private, coaching and cram-classes, examinations, conferences and other modes by which knowledge now seems best imparted and retained, the following educational methods will be prominent:

LECTURES. The Trustees desire that each instructor of however few students, should prepare and deliver regular lectures, with diagrams, illustrative apparatus and references to standard text books, and the best current literature upon each topic. Advanced students and instructors will also be encouraged to supplement the work of the professors by giving occasional special lectures and courses. Public lectures will from time to time be given.

SEMINARIES. These are stated, perhaps weekly, meetings, often in a department library, for joint, systematic, but conversational work, under the personal direction of the professor, in some special chapter of his subject. Here the results of individual reading are reported for the benefit of all; views are freely criticised; new inquiries, methods, comparisons, standpoints, etc.,

suggested. From the mutual stimulus thus given many important works have proceeded, and the efficiency of universities, especially in Germany where seminaries were first generally introduced, has been greatly increased.

LABORATORY WORK. For beginners this was from the first the best of all forms of apprenticeship, bringing student and professor to a far closer and mutually stimulating relation. Here the manipulation of apparatus is learned, each well-chosen piece of which is an obvious epitome of long lines of research; processes are criticised, results obtained by other investigators are tested, methods are discussed and perfected. The modern laboratory has thus become an unexcelled school of logical mental discipline, from which is developed, as its best product, that rare independence in research which is the consummation of scientific culture.

LIBRARY FACILITIES.

The University Library, which has already on its shelves over 10,000 bound volumes with large orders still unfilled, has been selected to represent chiefly the five departments. The books are accordingly grouped as follows: Mathematical, Physical, Chemical, Biological, (including Anatomy and Physiology), Psychological, (including Neurology and Anthropology), Reference, General and Miscellaneous.

Full sets of the standard serials and archives in the various Departments have been secured.

All the leading scientific Journals, especially in the five departments, are taken and kept in a large reading room adjoining the main Library room. In all 197 periodicals are now received.

All the privileges of the Library are open to all Appointees of the University alike.

The Library is open from 8 A. M. to 10 P. M. and each member of the University has direct access to every book and journal.

Outside the University are found;

The Library of the Antiquarian Society, organized in 1812, containing 85,000 volumes, is accessible to all members of the University.

The Worcester Public Library, containing about 250 periodicals and 75,000 volumes, has supplemented the scientific publications purchased by the University and all the privileges are accessible without charge.

A medical Library of 8,000 volumes is also accessible.

By the courtesy of the Librarian of Harvard University and of the Surgeon General at Washington books from both these institutions are sent to the University for a limited time.

By an arrangement with several large book dealers the latest publications from Europe as well as from this country are exposed for inspection or sale upon the Library tables.

NOTICES.

The charge for tuition, giving all the privileges of the

University, but not covering laboratory fees, is $200 per annum.

Board and lodging can be obtained near the University at very moderate rates.

urther announcements will be made from time to time during the summer.

Intending students will, so far as possible, be informed upon any of these or other points, in advance of official announcement, upon addressing the Clerk,

L. N. WILSON,
WORCESTER,
MASS.

DEPARTMENTS.

The statements of the instructors concerning the courses given during the academic year 1889–90, which follow, are supplemented by announcements of the work to be done during the academic year 1890–91, so far as can be done at the date of issue. These announcements can now be complete only in the case of Professors and Assistant Professors. Further announcements for Docents as well as the work for new Instructors who may be appointed before the beginning of the next academic year will be made later. Only a few standard courses will be repeated in successive years.

I.

MATHEMATICS.

Work of the Past Year.

Instruction has been given in this Department during the current year by

W. E. Story, Ph. D., Professor of Mathematics.
O. Bolza, Ph. D., Associate in Mathematics.
H. Taber, Ph. D., Docent in Mathematics.
R. A. Harris, Ph. D., Fellow in Mathematics.

PROFESSOR STORY

Has directed courses of reading in the following subjects, supplementing the text books by lectures five times weekly:

I.—Modern Higher Algebra; symmetric functions of the roots of an algebraic equation or a system of such equations, differentiants, Sylvester's fundamental theorem, invariants, covariants, ground-forms, the method of generating functions, symbolic methods, eliminants and discriminants.

II.—Higher Plane Curves; homogeneous point and line co-ordinates, principle of duality, poles and polars, singularities, Pluecker's formulæ, envelopes, reciprocal curves, metrical properties.

III.—General Theory of Surfaces and Twisted Curves; homogeneous coordinates, singularities of surfaces, curvature, singularities and classification of twisted curves, ruled surfaces.

IV.—Theory of Numbers; divisibility of numbers, primes totients, congruences, Fermat's and Wilson's theorems generalized, solution of linear congruences, primitive roots, quadratic residues theorem of reciprocity.

V.—Calculus of Finite Differences; differences of successive orders, symbolic methods, interpolation, approximate summation, convergency of series, solution of difference equations, functional equations.

VI.—Calculus of Probabilities; fundamental theorems, combinations and permutations, repetitions, mathematical and moral expectation, Bernoulli's theorem, theory of errors of observations, method of least squares.

VII.—Quaternions; vector analysis, ratio of two vectors as an operator, general formulæ, differentiation, linear vector function of a vector, solution of linear equations, applications to geometry and physics.

VIII.—Modern Synthetic Geometry; principles of projection, idea of measurement unnecessary, projectivity and perspectivity of images, harmonic relation, anharmonic ratio (only incidentally), projective properties of conics (incidentally their metrical properties), extension to three dimensions.

Professor Story has also given a course of lectures on Analytic Mechanics (including the statics and dynamics of a particle and of a rigid system, and general methods of treating the motion of a system subjected to given restrictions), twice weekly since the middle of February.

DR. BOLZA

Has given the following courses, five times weekly:

I.—Definite Integrals; fundamental properties and methods of computation of simple integrals, Eulerian integrals, double integrals, line-integrals, Fourier's series and integrals.

II.—Calculus of Variations; absolute maxima and minima of a simple integral containing one unknown function and its first derivative, second variation, variable limits, relative maxima and minima, case of several unknown functions, double integrals, conditions of integrability.

III.—Elliptic Functions; elliptic integrals, reduction to normal form, additional-theorem, the three elliptic functions snu, cnu, dnu, the function $\Theta(u)$, methods of numerical computation, applications.

IV.—THEORY OF FUNCTIONS; conform development, Cauchy's theory of definite integrals between complex limits, Taylor's series.

Dr. Bolza has also given a special course on THEORY OF FUNCTIONS, comprising Weierstrass' theory of elliptic functions and Riemann's theory of hyperelliptic integrals; twice weekly.

DR. TABER.

Has given a course of lectures on the Theory of Matrices, including the substance of Cayley's *Memoir on Matrices*, Sylvester's various papers in the *American Journal of Mathematics*, *Johns Hopkins University Circs.*, *Philosophical Magazine*, Clifford's *Fragment on Matrices*, and Bucheims' extension of Clifford's method. The point of view from which the subject has been treated, has been that of Dr. Taber's paper on the Theory of Matrices shortly to appear in the *American Journal of Mathematics*.

In addition the following topics have been treated: Relation of the Theory of Matrices to Hamilton's Linear Vector Functions, to the Logic of Relatives, and to Linear Associative Algebra and Multiple Algebra in general (Peirce: *American Journal of Mathematics*, vol. iv); Relation of Clifford's System of Geometrical Algebras to the Theory of Matrices; the Theory of Quaternions viewed as the Theory of Matrices of the second order; and the application of the Theory of Matrices to the Linear Automorphic Transformation of a Bipartite Quadric Function.

DR. HARRIS

Has given a short course of Lectures on the APPLICATION OF THE THEORY OF FUNCTIONS TO THE CONSTRUCTION OF MAPS.

WORK OF THE NEXT YEAR.

During the year 1890–91, an INTRODUCTORY COURSE will be given, in two sections:

SECTION A. (PROFESSOR STORY, Three times weekly.)

General Theory of the Higher Plane Curves.

General Theory of Surfaces.
Finite Differences.
Probabilities.
Quaternions.

SECTION B. (DR. BOLZA, Three times weekly).

Definite Integrals.
Differential Equations.
Calculus of Variations.
Elliptic Functions.
General Theory of Functions.

PROFESSOR STORY will also lecture two or three times weekly on (a) NON-EUCLIDEAN GEOMETRY, during the first half-year; (b). SPECIAL TOPICS IN ANALYTIC GEOMETRY, during the second half-year;

And will direct work in such other special lines as may be required.

In connection with each of the advanced courses (a) and (b), Professor STORY will conduct a Seminary in which the student will be led to independent investigation of problems which may arise in the course of the lectures.

DR. BOLZA will give the following advanced courses:

1.—THEORY OF FUNCTIONS, including Weierstrass' Theory of Elliptic Functions. (First half-year, two hours weekly).

2.—THEORY OF SUBSTITUTIONS, and its applications to algebraic equations. (Second half-year, two hours weekly).

In connection with these lectures, DR. BOLZA will conduct a Seminary devoted to the analysis of original papers.

FACILITIES.

The facilities to be found here for the study of mathematics in its various branches are unexcelled in this country. The library is provided with complete sets of all the more important current mathematical periodicals and the publications of the scientific societies of the world, with the standard treatises on the subjects now particularly engaging the attention of mathematicians, the collected works of the great mathematicians, and many books

illustrating and discussing the history of mathematics; to which will be added from time to time such other works as may be needed or appear desirable. The department is also equipped with full sets of Brill's admirable models of mathematical surfaces and Björling's thread models of developable surfaces.

Personal guidance will be given each year, as far as possible, to advanced students desirous of pursuing the study of subjects in which courses of instruction are not specially announced.

Researches of the Members of this Department.

Professor Story is the author of the following papers:

On the Algebraic Relations existing between the Polars of a Binary Quantic. Thesis for the degree of Doctor of Philosophy. Leipsic, 1875.

On the Elastic Potential of Crystals. Am. Jour. of Math., Vol. I, pp. 177–183.

Note on Mr. Kempe's Paper on the Geographical Problem of the Four Colours. Ibid., Vol. II, pp. 201–204.

Note on the "15" Puzzle. Ibid., Vol. II, pp. 399–404.

On the Theory of Rational Derivation on a Cubic Curve (followed by a note on Totients). Ibid., Vol. III, pp. 356–387.

On the Non-Euclidean Trigonometry. Ibid., Vol. IV, pp. 332–335.

On the Non-Euclidean Geometry. Ibid., Vol. V, pp. 180–211.

On Non-Euclidean Properties of Conics. Ibid., Vol. V, pp. 358–381.

On the Absolute Classification of Quadratic Loci, and on their Intersections with each other and with Linear Loci. Ibid., Vol. VI., pp. 222–245.

The Addition-Theorem for Elliptic Functions. Ibid., Vol. VII, pp. 364–375).

A New Method in Analytic Geometry. Ibid., Vol. IX, pp. 38–44).

During the current year Professor Story has been engaged on a series of investigations in the Non-Euclidean Geometry, the results of which he is embodying in a memoir, probably soon to be ready for the press.

Dr. Bolza is author of the following researches:

Ueber die Reduction Hyperelliptischer Integrale auf Elliptische. Math. Annalen, Vol. 28.

Darstellung der Binärform sechster Ordnung durch die Nullwerte der zugehörigen Functionen. Math. Annalen, Vol. 30.

On Binary Sextics with Linear Transformations into Themselves. Amer. Jour. of Math., Vol. x.

On the Construction of Intransitive Groups. American Journal of Math., Vol. xi.

DR. TABER
is the author of a paper "On the Theory of Matrices" in which a matrix is regarded as a linear Vector Operator (i. e., as an operator linear and distributive over the units of an algebra) and thus obtained a very simple development of the subject including Sylvester's most important theorems.

He has continued the investigations of this paper and their application to Nonions, and the results are now nearly ready for publication. In addition he has extended some results previously obtained on the development of Clifford's geometrical algebras and their application to non-euclidean geometry.

DR. HARRIS has written:

"The Theory of Images in the Representation of Functions." Annals of Math. June 1888.

"Note on the Theory of Images." Ibid. August 1888.

"On the Expansion of $\mathrm{sn}x$"; pp. 4. *Annals of Mathematics.* Vol. iv., No. 3.

II.

PHYSICS.

Work of the Past Year.

Instruction has been given in this department during the current year by

A. A. Michelson, Ph. D., Professor of Physics.
A. McAdie, M. A., Fellow in Physics.

PROFESSOR MICHELSON

has given the following courses of lectures:

(1) Wave Motion, (2) Undulatory Theory of Light, (3) Minor Course in Electricity and Magnetism.

Mr. A. McAdie, who was appointed Fellow in Physics, has also given lectures on Meteorology. A large room (No. 78) has been fitted up as a special laboratory for electrometry for him.

In atmospheric electricity, two principal lines of investigation have been followed—first, the obtaining of a continuous record of the changes in the electrical potential of the atmosphere; and, secondly, the devising and construction of an electrometer that would give this record without the employment of photography. The disadvantages of the photographic method are obvious, but, on the other hand, it has not yet been possible to obtain by mechanical means any record of the needle oscillations. To meet this problem, a Multiple Quadrant Electrometer (a description of which may be found in "Proc. Amer. Acad.," June, 1885), with some important modifications, has been constructed by Brashear of Allegheny. This instrument is of the utmost value in the study of the potential of the atmosphere, for various reasons, chief among which are, that it gives a *complete* record of the movements of the electrometer needle (which is not the case with photogra-

phy); that it allows easy and quick inspection of the record at any time, and the detection of inaccuracies; and that it is more economical in the long run, has a far greater range of sensitiveness, and lacks several of the sources of error constant in electrometers of the ordinary quadrant type. It is the only instrument capable of giving a true record of the potential changes occurring during a thunder-storm.

Work for Next Year.

PROFESSOR MICHELSON.

During the coming year the theoretical work will consist of a course of lectures for students in Physics, and a minor course for others. The former will be a continuation of the present course of lectures on the Undulatory Theory of Light, and will embrace the usual topics, such as:— Historical Summary of the Undulatory Theory; Theory of Interference Phenomena, and examples of important cases of interference, such as Fresnel's mirrors, refractometers, colors of thin films, diffraction and its application to the theory of the telescope, microscope and spectroscope, the theory of gratings, and of rainbows and coronas.

The subjects of Polarization and Double Refraction will be fully treated from the theoretical standpoint, and also in relation to its applications to photometers, heliometers and polaristrobometers.

In addition, Professor Michelson intends to include a detailed account of the results of his own investigations on the velocity of light in air and in liquid media; on the effect of the motion of the medium on the velocity of light, and its bearing on the problem of the motion of the solar system through space; on the application of interference methods to precise measurements, including micrometrical, telescopic and spectroscopic. The course will conclude with an account of the recent progress in the investigation of the relations between light, electricity and magnetism.

The work of experimental research is to be devoted chiefly to the problem of defining the length of the standard meter in terms of a light wave; to ascertaining the relative length of a few light waves with the utmost attainable precision; and to certain inter-

ference phenomena having a direct and important bearing on the kinetic theory of gases.

Besides this, especial attention will be given to the general problem of the practical application of interference methods to measurements of length and angles. As instances of the class of problems falling under this head, in addition to those already referred to may be mentioned the following: replacement of mirrors in galvanometers, electrometers, and all other instruments in which the method of mirror and scale is employed, by refractometers; measurement of co-efficients of elasticity and of expansion; measurement of index of refraction of solids, liquids and gases.

For the first-named work, a very accurate and well constructed instrument (by J. A. Brashear) is to be employed in connection with the large interferential comparer which was originally employed in this work. It is hoped that by this means it will be possible to define the unit of length in terms of the unalterable length of some standard radiation, and to reproduce this standard (or a large multiple of it) with a degree of accuracy exceeding that now attainable, even in copying one standard from another.

MR. McADIE.

Some experiments will be made during the thunder-storm season, bearing on the question of nervous excitement, depression, hysteria, etc., so prevalent, especially among women, during thunder-storms, and their possible connection with the marked variations in pressure, humidity, temperature and electrical potential of the atmosphere occurring at these times.

FACILITIES.

The following rooms have been assigned for the use of the Physical Department:

On the lower floor, or basement, are three rooms to be used for experiments requiring great steadiness and freedom from vibration. The end-room is designed for magnetic and electrical work. It has been deemed advisable to omit from it the piers and other fittings which it is to have ultimately, so that they may be appro-

priately fixed for special work. At present this room is used by Mr. Wadsworth.

The second room has been provided with solid piers and with a partition which provide steadiness and uniform temperature. The experiments on measurements of wave-lengths, and any similar work, are to be conducted in this room. Between the partition and the windows are two piers for spectroscopic work.

The third room is also designed for delicate experiments requiring stability. It will contain, besides the astronomical clock and Becker balances which it now has, a chronograph and a cathetometer.

The fourth room has been fitted up as a general workshop. It contains lathe, carpenter's bench, etc. This room communicates with a larger room in which the engine, dynamos and other heavy machinery are to be placed, the boiler being in the "general boiler-room."

On the second floor are three rooms, the first of which is the private laboratory and office of Professor Michelson. The next room contains cases for apparatus not in use, as well as tables for work not requiring great steadiness. The third room is used as a lecture-room.

The following may be mentioned as among the more important pieces of apparatus:—

Armington & Sims Engine, 10 H. P., Screw cutting lathe, Edison Dynamo, Becker balance, 1000 gm., dividing engine, cathetometer, Rowland's Spectrometer, with 6 in. concave grating, astronomical clock, chronograph, Ritchie air pump, Ruhmkorff coil, 30 cm. spark, revolving mirror, refractometer (for measuring wave-lengths).

In addition to the facilities briefly mentioned, in the way of apparatus for original investigation, it is proper to mention that the physical library includes most of the modern standard works of reference and physical journals. Among the latter is a complete set of the *Annalen der Chemie und Physik;* of the *Comptes Rendus; Proc. Roy. Soc.*, etc.; and *Phil. Mag., Am. Journal; Journal de Physique*, and other works.

Researches of the Members of this Department.

Professor Michelson has published the following papers:—

"Experimental Determination of the Velocity of Light." I. Proc. A. A. A. S., 1879.

"Experimental Determination of the Velocity of Light." II. Proc. A. A. A. S., 1880.

"A Method for Determining the Rate of Tuning Forks." Am. Journal, January, 1883.

"Experimental Determination of the Velocity of Light." III. (Astr. Papers of the Nautical Almanac, Vol. II.

"Velocity of Light in Carbon Disulphide and Velocity of Red and Blue Light in same." Ibid., Vol. 11.

"The Relative Motion of the Earth and the Luminiferous Ether." Am. Journal of Science, August, 1881.

"A New Sensitive Thermometer." Journal de Physique, 1882.

"Interference Phenomena in a New Form of Refractometer." Am. Journal, May, 1882.

"M. Wolf's Modifications of Foucault's Apparatus for Measuring the Velocity of Light." Nature, May 7, 1885.

"Influence of Motion of the Medium on the Velocity of Light." Am. Jour., May, 1886.

"On the Relative Motion of the Earth and the Luminiferous Ether." Phil. Mag., November, 1887.

"On Method for Making the Wave Length of Sodium Light, the Absolute and Practical Standard of Length." Am. Jour., December, 1887.

"On the Feasibility of Establishment of a Light Wave as the Ultimate Standard of Length." Am. Jour., Sept., 1889.

"Measurement by Light Waves." Am. Jour., Feb., 1890.

"A Simple Interference Experiment." Am. Jour., March, 1890.

After some necessary delay in the preparation of rooms, piers, machinery, etc., an important investigation into the application of interference methods to astronomical problems has been undertaken, the results of which are soon to be published.

Mr. McAdie is the author of the following researches:

Atmospheric Electricity.—American Academy of Arts and Sciences, June, 1885.

Atmospheric Electricity at High Altitudes.—Am. Acad., June, 1885.

The Aurora.—U. S. Signal Service Note, No. XVIII.

Electrometer Measurements.—U. S. Monthly Weather Review, 1886–7.

Atmospheric Electricity.—Am. Meteor Journal, March, 1885, to Jan. 1890.

Memoir of Professor William Ferrel.—Reprinted.

Second prize of $50 for best essay on "Tornadoes," offered by Am. Journal of Meteorology, 1889, and various smaller papers.

The research for the year has been on ATMOSPHERIC ELECTRICITY, particularly in the following directions:

1. The obtaining of a continuous record by photography, of the variations in the electrical potential of the air.

2. Special studies of these variations at times of thunderstorms.

3. On the oscillatory character of the lightning discharge.

Material for papers on the first two subjects is at hand, and will be utilized.

III.

CHEMISTRY.

Work of the Past Year.

Instruction has been given in this department by
J. U. Nef, Ph. D., Assistant Professor of Chemistry.
F. W. Muthmann, Ph. D., Docent in Chemistry.
M. Loeb, Ph. D., Docent in Chemistry.
J. F. Williams, Ph. D., Honorary Fellow in Chemistry.
C. W. Marsh, Ph. D., Honorary Fellow in Chemistry.

The department of chemistry has been for most of the current academic year without a head. It is hoped that this position will soon be adequately filled.

DR. NEF.

During the past year Assistant Professor Nef, who, since Dec. 1st has acted as head of the Laboratory, has lectured as follows:

1st. Non-metals, twice a week until Dec. 1st. This course was then continued by Dr. Loeb.

Advanced lectures on Hydrogen, the Halogen and Oxygen groups, and on Nitrogen; their compounds with Hydrogen and the Halogens with special reference to recent work on these subjects.

2d. A course of Lectures on Organic Chemistry from Dec. 1st to the end of the year, two hours per week.

Until March 1st special lectures were given on the fatty compounds, confined to the hydrocarbons, their halogen and nitro derivitives, the alcohols, ethers, amines, ketones, aldehydes, acids and the metallo-organic compounds. Besides discussing the characteristic reactions and relationships of these compounds, most attention was given to recent work on the subject.

Since March 1st lectures on the Aromatic Series have been

taken up. The object here again was to discuss the most recent advances made (four lectures alone being given on the constitution of Benzol), and so to incite the men to original methods of thinking and to become familiar with the chemistry of to-day as presented in the original papers.

DR. MUTHMANN.

Dr. Muthmann gave a two month's course of lectures in German on Analytical Chemistry. In this course a general review of the qualitative reactions of the important metals was given, and a more detailed description of the quantitative methods of their determination and separation.

March 1st he commenced a series of lectures, in English, on the rare metals and earths. In these lectures he took up the acid-forming metals and their compounds with other elements. The latter part of the session is devoted to the rare earths and an exact description of the different methods of their separation and quantitative determination.

DR. LOEB.

Dr. Morris Loeb has given one lecture each week since the 2d of Oct. on Physical Chemistry, embracing an historical review of stoëchiometry; the physical characteristics of gases treated empirically and theoretically, with their application to molecular problems; the relations between the gaseous and liquid states; the behavior of mixtures and the chemical problems involved; the properties of solids; optical phenomena; an glance at the scope of thermo chemistry and electro chemistry.

He has also given a course of lectures on Non-metals and Inorganic Acids. These lectures were a continuation of Dr. Nef's course and were given twice a week from Dec. 1st to March 1st.

In these lectures the negative elements of the V, VI and VII natural groups were discussed with regard to their analogous compounds and their distinguishing reactions; the oxides were then taken up separately, and acids, finally, were treated more from a theoretical than a descriptive standpoint, especial regard being paid to the typical stages of hydration, oxidation and substitution.

DR. WILLIAMS.

Dr. J. Francis Williams was granted leave of absence early in Oct. 1889, for the purpose of working up the crystalline rocks of Arkansas, for the state geological survey. The field-work lasted until the beginning of the present year, and since that time the petrographical and chemical investigation of the material collected on the Arkansas trip has been in progress.

Among the facts which have already been brought out by this work, may be mentioned the occurrence of eudialyte and eucolite in the elaeolite syenite of Magnet Cove, and of leucite in much of the rock from the same locality, and the identification of several minerals, such as fluorite, apatite, etc., which have up to this time been, either undetermined or mistaken for some other species.

Lectures on crystallography, with practice in determination of forms, have been given once a week since January first and will be continued until June.

The appliances for work in crystallography, outside of the chemical equipment, consist of a reflecting goneometer, from R. Fuess, Berlin, a horizontal axial angle instrument, a Voigt and Hochgesang polarization microscope for petrographical work on thin sections, and a polariscope for the examination of thick sections. Of these, the first two are placed in a well appointed dark room, while the latter are used in a room which has been specially fitted with such appliances as are required for work with them. A cutting and polishing machine, for use in making thin sections of rock and minerals, completes the list of apparatus at present here; but there has been ordered from Germany, a set of instruments, very similar to those enumerated above, which will be the property of the University, while those described here are all the personal property of Dr. Williams.

DR. MARSH.

Dr. Charles W. Marsh has given a course of ten lectures on Methods of Organic Analysis.

Laboratory Work.

The laboratory instruction this year has been under the super-

vision of Drs. NEF and MUTHMANN, the former paying special attention to students at work on organic preparations or prosecuting research work in organic chemistry, the latter devoting himself to those engaged in qualitative and quantitative analysis and those prosecuting research work in inorganic chemistry.

In the organic preparation work, Emil Fischer's book is followed, and the men are strongly advised to devote all the time possible to reading the original papers in connection with their work.

In quantitative and qualitative analysis the pamphlets of Volhard and Zimmermann are used.

WORK OF NEXT YEAR.

DR. NEF.

During the coming year DR. NEF will offer the following courses:

A course of lectures similar in scope and object to those given this year, but more advanced. To understand these lectures a good knowledge of organic chemistry is necessary.

Lectures on the POLYATOMIC FATTY COMPOUNDS, with special attention to the urea and sugar group. On the more complicated aromatic compounds, with special reference to quinoline and pyridin derivates. Lectures two hours a week throughout the year.

The chief object in these lectures will be to discuss recent work in these lines, and the student will be expected to spend much time in reading the original papers.

DR. MUTHMANN.

During the coming year DR. MUTHMANN will give two courses of lectures. The FIRST will be on the SPECIAL CHEMISTRY OF MINERALS, in which he will treat of the relations, chemical and crystallographical, which exist between inorganic bodies occurring in nature. He will refer especially to the chemistry of Silicates, according to the system developed by Groth. The lectures in this course will be given twice a week for the first half of the year.

The SECOND course will be on SPECTRUM ANALYSIS. In these lectures he will discuss the optical theory of the subject, and give

a brief description of qualitative spectrum analysis. An exact description of quantitative spectrum analysis, with practical exercises in photometric spectral methods, will end the course. Lectures in this course are given twice a week during the second part of the year. Four hours a week will be devoted to the practical exercises under Dr. Muthmann's direction on this subject during the latter half of the term.

Rooms and Facilities.

A large Chemical Building, described elsewhere, has been completed and about half of the rooms already equipped for scientific work.

On the second floor of the chemical building is a large research room, and adjacent to it a store room, balance room, and combustion room, and lecture room. On the first floor is a steam room and air furnace room.

The large research room has ten working tables, each 12 feet long, and provided with gas and water and a trough in the middle — making it possible to carry on filtration, distillation in vacuum, and most chemical operations even on a large scale. There are sinks at each end of the tables, and for each table a separate large glass hood (2 x 5 ft.) with a height of 5 feet, making ten hoods in all.

On the third floor is the library, a large room equipped with all the periodicals, past and current, necessary for research work.

Dr. Nef has a large room fitted up for his organic research work. It contains a desk equipped with gas and water and a lead trough just as the research room desks; also a large glass hood nine feet long, a sink, and a foot bellows and blast lamp.

Dr. Muthmann has three rooms at his disposition.

1. A room for microscopic and spectroscopic work, equipped with an analytical balance, a Fuess' microscope and polarization apparatus; a Krüss' spectral apparatus for qualitative and quantitative analysis, as well as for spark-spectra.

2. A dark room, equipped with a Fuess' goniometer, No. 2, with arrangements for monochromatic light and for measuring optical axes and refractive indices of crystals.

3. A small place in the cellar is fitted up for nursing crystals at low and constant temperature.

While instruction and direction in laboratory work is first in importance, the student will be expected to acquire a thorough knowledge of recent work in many lines of both inorganic and organic chemistry. It is only by this method that he will be able to concentrate his energies and do good independent work in a single direction, which it is especially desired to encourage here.

Just as a good training in organic preparation work is now considered an essential preliminary to successful research work in organic chemistry, so it is desirable that men should have preliminary training in working with the rarer inorganic elements before commencing research work in inorganic chemistry.

Every incitement and encouragement is given to mature men who have already taken the degree of Ph. D. to come here and pursue a special line of work with a view to presenting themselves eventually as candidates for docentship, which confers upon them the privilege of giving lectures and instruction as in the German Universities.

Investigations by Members of this Department.

Dr. Nef has published the following papers:

The Volumetric Determination of Combined Nitrous Acid. Amer. Chem. Jour., Vol. v, p. 388. [With Dr. Kinnicutt].

Ueber einige Derivate des Durols. Ber. d. deutsch. chem. Gesell, 1885, 2801.

Ueber Benzochininon-carbonsäuren. Ber. d. deutsch. chem. Gesell, 1885, 3498.

Ueber Benzochininon-carbonsäuren. { Liebigs Annalen, 237, 1. / Journal Lond. Chem Soc., 1888, 428.

Ueber das Py-3 Phenylchinaldinsäure und das Py-3 Phenylchinolin. Ber. der deutschen Chem. Gesell, 1886, 2427. [Mit Dr. Koenigs.]

Ueber das Py-3 Phenylchinolin und Py-3 B Dichinolyle. Ber. der deutsch. Chem. Gesell, 1887, 622. [Mit Dr. Koenigs.]

Nitranilsäure aus Chloranil. Ber. der deutsch. Chem. Gesell. 1887, p. 2027.

On Tautomeric Compounds. Am. Chem. Jour. xi, 1.

The Constitution of the Anilic Acids. Am. Chem. Jour. xi, 17.

Three lines of work have been under way during the past year. In two of these, sufficient progress has been made, so that the results have been sent off for publication.

DR. MUTHMANN has published the following:

Über niedere Oxyde des Molybdänns. Inaugural Dissertation, München, 1887. Liebigs Annalen, 238, 108.

Über Polymorphie und Mischkrysballe einiger organischer Substanzen. Zeitschr. f. Krystallogr., 15, 16.

Krystallographisch-chemische Notizen. Ibid., 15, 387.

Krystallographische Untersuchung der Phtalsäure, und einigen Derivate der Selben. Ibid., 17, 73. [With W. Ramsay].

Messelit, ein neues Mineral. Ibid., 17, 93.

Udtersuchungen über den Schwefel und das Selen. Ibid., 17, 336.

Zur Frage der Silberoxydulverbindungen. Ber. d. Deutch. Chem. Gessellsch., 20, 983.

Krystallographische Untersuchung einiger Derivate der Terephtalsäure. Zeitschr. f. Krystallogr., 17, 460.

This last is an investigation conducted during this year at the University.

DR. LOEB is the author of the following:

Ueber die Einwirkung von Phosgen auf Aethenyldiphe Fnyldiamin. Berichte d. deutsch. chem. Gesellschaft XVIII, 2427.

Ueber Amidinderivate. Ibid. XIX, 2340.

Das Phosgen und seine Abkömmlinge. Dissertation Berlin, March 15, 1887, pp. 51.

The Molecular Weight of Iodine in its Solutions—Journal Chemical Society, LIII, p. 805. Also Zeitschrift für Physikalische Chemie II, 606.

The use of Aniline for absorbing Cyanogen in gas analysis—Journal Chemical Society, LIII, p. 812.

The rates of transference and the conducting power of certain silver salts.—With W. Nernst in American Chemical Journal. Vol. XI, p. 106. Also Zeitschrift f. Phys. Chemie. II, p. 948.

DR. WILLIAMS has published the following papers:

Tests of Rutland and Washington County States.—Van Nostrand's Eng. Mag. No. CLXXXVIII, 1884.

Ueber den Monte Amiata in Toscana und seine Gesteine.—Stuttgart, 1887.

DR. MARSH has published the following:

"Note on the Ammonia Process for Water Analysis." Am. Chem. Jour. Vol IV, No. 3.

"A method for the Detection of Chlorine, Bromine, Iodine, and Sulphur in Organic Compounds." Am. Chem. Jour. Vol. XI, No. 4.

"A New Form of Adapter," Am. Jour. of Analytical Chem., Jan. 1889.

"The Reduction of Barium Sulphate to Barium Sulphide on Ignition with Filter Paper." The Jour. of Analytical Chem., April, 1889.

DR. STEIGLITZ has published a dissertation entitled:

"Ueber das Verhalten der Amidoxime gegen Diazobenzol Verbindungen." Berichte d. deutsch. chem. Gesellschaft.

IV.

BIOLOGY.

Work During the Past Year.

Instruction has been given in this department as follows:

Animal Morphology.

C. O. Whitman, Ph. D., Professor of Animal Morphology.
J. P. McMurrick, Ph. D., Docent in Animal Morphology.
H. C. Bumpus, M. A., Fellow in Animal Morphology.

Vertebrate Anatomy.

F. P. Mall, Ph. D., Adjunct Professor of Anatomy.
F. Tuckerman, M. D., Fellow in Anatomy.

Physiology.

W. P. Lombard, M. D., Assistant Professor of Physiology.

A.—ANIMAL MORPHOLOGY.

PROFESSOR WHITMAN.

Professor Whitman has given a course of historical lectures, covering a portion of the ground outlined in the first two courses announced for the next session. These lectures were intended to set forth the more important part of biological philosophy and discovery from the time of Aristotle up to the present. As no adequate treatise on the subject, from the standpoint here taken, has hitherto been produced, it became necessary to enter upon a long and laborious examination of the original works. The aim has been to work out the subject, not after the manner of descriptive history and biography, but from the standpoint of connected development—to trace the march of discovery, the gen-

esis of ideas, the progress of thought, and the origin, foundation, and relations of doctrines, systems, and schools. The task is important as it is arduous, and a number of years of solid work will be required to complete it. The entire time thus far, except what has been absorbed in editorial duties, and in the supervision of laboratory work and equipment, has been devoted to this task.

DR. McMURRICH.

Dr. McMurrich has delivered a course of lectures on the Morphology of the Cœlenterata, giving a detailed account of the morphology, histology and embryology of the Porifera and Cnidaria, discussing the general questions arising in connection therewith, such as the origin of the nervous system, the origin of alternation of generations in the Hydromedusæ, the origin and affinities of the Siphonophores, and the phylogeny of the various groups, concluding with a discussion of the Gastræa theory.

He has also made a thorough study of the structure of Cerianthus Americanus, the results of which are now ready for publication. An investigation of the embryology of the Actiniæ has also engaged his attention, as well as the study of a collection of Actiniæ obtained by the U. S. Fish Commission Steamer "Albatross," on her voyage to San Francisco during the winter of 1887–1888.

MR. BUMPUS.

Mr. Bumpus has lectured on "Affinities of the Crustacea."

B.—ANATOMY.

DR. MALL.

Dr. Mall has lectured throughout the year upon the histology of the tissues arising from the mesoderm.

DR. TUCKERMAN.

Dr. Tuckerman has delivered a brief course of lectures upon the Histology of the Gustatory Organs of Mammals.

DR. GAGE.

Dr. Gage has investigated some special properties of the intestines.

DR. MILLER.

Dr. William S. Miller has been at work during the present year upon The Anatomy of the Lungs of Mammalia.

C.—PHYSIOLOGY.

DR. LOMBARD.

Dr. Lombard has lectured throughout the year upon nerve and muscle physiology, treating the following topics:

Properties of nerve and muscle.—Structure with reference to function.—Form of the muscle curve under various conditions.—Influences affecting the irritability of nerves and muscles.—Latent period of nerves and muscles.—Electrical condition during rest and action.—Electrotomes.—Effect of different forms of stimuli, variously applied.—Influences determining the work of muscles.—Chemistry of muscles.—Source of muscular energy.—Heat developed in muscles.—Effect of external influences on muscular action.—Fatigue.—Functions of cerebro-spinal, splanenic and sympathetic systems.—Ganglia.—The white and grey matter of the spinal cord.—Reflex action, etc., etc.

As the lectures were attended by men who were already familiar with the subject, and who were engaged in research in closely allied departments, the lecturer sought not only to recall to their minds what is known, but to teach how these facts were discovered. The lectures were, therefore, freely illustrated by experiments, and much time was given to description of apparatus and methods, in the hope that those engaged in research would have their attention called to new ways of attacking the problems upon which they were engaged.

DR. CARDWELL.

Dr. Cardwell has acted in the Physiological Laboratory as assistant to Dr. Lombard in the preparation of his lecture experiments and in his research work.

Dr. C. F. Hodge, Mr. Nichols and Mr. Fulcomer, from the Psychological department have availed themselves of the privileges of the laboratory for the prosecution of portions of the researches upon which they were engaged.

Work for Next Year.

A.—ANIMAL MORPHOLOGY.

PROFESSOR WHITMAN.

Professor Whitman will offer next year three courses of lectures, two historical and one embryological.

1. The first historical course will deal with the *Development of Comparative Anatomy*, beginning with Marco Aurelio Severino, and ending with the discussions of 1830 between Etienne Geoffroy Saint Hilaire and Georges Cuvier. The leading aim in this course will be to show how Comparative Anatomy, starting as the handmaid of Physiology, gradually outgrew its ancillary condition, and became an independent branch of Zoölogy, with aims, conceptions, principles, and methods distinctly its own. Attention will be directed particularly to the origin and development of historic ideas, tendencies, methods and schools, as presented in the early iatric and physiological stages of Zoötomy; in the schools of Haller, Geoffroy, and Cuvier; in the "Anatomie Philosophique" of the French, and the "Naturphilosophie" of the Germans; in the doctrines of the "Scale of Nature," "Unity of Composition," and of Types; in the hypotheses of Evolution and Epigenesis, in Homology and Teleology, etc. The biographical side of the subject will also receive due consideration, especially in the case of such representative men as Malpighi, Swammerdam, and Leeuwenhoek of the 17th century, and Haller, Buffon, Daubenton, Linné, John Hunter, Camper, Vicq d'Azyr, Kielmeyer, Geoffroy, and Cuvier of the later period.

2. The second historical course will be devoted to a critical survey of the subject of *Generation*, embracing an analytic and comparative study of those systems which have marked the high-water level of biological thought at successive epochs from the time of Aristotle to the present.

Following the order of logical dependence rather than of chronological sequence, attention will be concentrated upon those ideas and systems, which have had the most influence in determining the general course of speculation and discovery, and which, therefore, have not only an historical, but also a present, living interest.

The doctrine of Evolution, as it stood in the minds of its originators, Malpighi, Swammerdam, and Leeuwenhoek, as advocated by Leibnitz and Malebranche, and as elaborated and defended by Bonnet and Haller, will be examined at some length, on account of its peculiar historical interest, and especially because modern Evolution has been identified with the old Evolution as finally defined by Bonnet. The identification may be, in fact is, erroneous, but the search for points of contact and of difference is not the less instructive.

The theory of Epigenisis, as developed by Aristotle, Harvey, John Hunter, and Wolff, and as confirmed and extended by von Baer and other embryologists in the earlier part of this century, will be considered *in extenso;* and its relations, both to the old and the new evolution, will be fully discussed.

The consideration of these subjects will involve theories of sex, fecundation, etc., and so will lead up to a review of modern theories of heredity, and the questions raised between the followers of Lamarck, Darwin, and Weismann.

3. The third course, devoted to *Comparative Embryology*, will extend through two or three years. The early part of the course will include, among others, the following topics:

The genesis of the ovum and of its envelopes, the constitution and structure of the ovum, spermato-genesis; maturation of ova and spermatozoa; the phenomena of fecundation, normal and pathological; theories of individuality and of heredity founded on these phenomena; origin and significance of fecundation; cytokinesis, caryokinesis and cytological terminology; the cleavage of the ovum; the different types of cleavage compared; experimental researches in cleavage; pregastrular stages of development; the gastrula, its different types and their derivation; formation of the embryo in vertebrates and invertebrates; double and multiple monsters; germ layers; the trochosphere, a comparison of larval

and fœtal types of development; budding and fission; metameric segmentation.

Laboratory work and lectures will be supplemented by personal instruction, conferences, etc.

The organization of this department will be carried forward as rapidly as practicable.

The highest state of efficiency and usefulness open to this department implies the power to avail itself of many natural advantages of a comparatively new world to the morphologist. Material long coveted by European naturalists lies within the reach of means that may be as easily supplied here as they have been in Europe for similar purposes.

Opportunities for study at a marine laboratory will be given to those connected with this department.

The publication of memoirs will be provided for in the JOURNAL OF MORPHOLOGY, which is under the editorial direction of Dr. Whitman.

An artist will be permanently connected with the laboratory.

It is hoped that by the opening of the next session, a BIOLOGICAL CLUB can be organized for the promotion of that important order of scientific activity which is dependent upon the cöoperative action of a number of specialists. The work of the Club, as now anticipated, will consist in the presentation of carefully prepared papers and lectures, on topics of both special and general interest, to be followed by general discussion.

The efficiency of such an organization, *caeteris paribus*, is measured by its *numerical* strength. It is on that ground alone that the project deserves special mention. The restriction of the work of the department to pure research removes a long-standing obstacle to the attainment of the end in view, and makes it possible to proceed on a strictly scientific basis. No attempt will be made to cover any branch of mophology which has not its special representative either in the academic staff, or among the Docents, Fellows, or Students of the department. Obviously an organization of the kind here contemplated cannot be a thing of spontaneous and sudden birth. But there can be no question that, from the

outset, very great advantages will flow from it. Through such an association, it becomes possible for investigators, while concentrating attention on a special line of work, to keep informed of the progress of discovery and thought in other branches of research. It is under such conditions that individual effort is stimulated, supplemented, and completed, and at the same time turned to the common advantage of all. Each works for himself, but all share the results. Therein lies the remedy for any dangers that may lurk in specialization.

DR. MC. MURRICH will offer during the session of 1890–91 a course of lectures in continuation of those delivered during the past year, reviewing the Morphology of the Ctenophora and of the Platyhelminths, and discussing the important morphological problems which arise in connection with a study of those groups.

B.—VERTEBRATE ANATOMY.

During the coming year Dr. Mall will give a course of lectures on the development, histology, and comparative anatomy of the organs arising from the endoderm.

Opportunities will be offered to advanced students desiring to investigate special subjects in vertebrate embryology and histology.

A practical course on histology, for beginners, will probably be given.

C.—PHYSIOLOGY.

DR. LOMBARD.

The work of next year will consist of lectures by DR. LOMBARD and others, research work, and practical laboratory work.

DR. LOMBARD will lecture upon the circulation of blood and lymph; respiration; nerve and muscle; and the spinal cord and brain. Further, it is possible that he will give a short course on the physiology of the special senses.

In addition to this a number of lectures will be given by Dr. Lombard and advanced students, upon special subjects in the line of their investigations.

A PRACTICAL LABORATORY COURSE will be offered. This will

occupy two hours a week, and will be intended for such students as have a good book-knowledge of physiology but lack practical training. The work will include the leading experiments of the preceding lectures. The character of the course will depend largely on the requirements of the students taking it.

Especial attention will be given to original work, and the laboratory will be open for this purpose throughout every week day. Either Dr. Lombard or his assistant will always be present. The apparatus is intended for use, and will be put at the disposal of every competent worker.

Opportunities will be given to men who wish to study experimentally special branches of physiology, with reference to their investigations in other departments of biology.

GEORGE BAUR, PH. D.,

Academy of Hohenheim, 1878–79; University of Munich, 1879–81; University of Leipzig, 1881–82; University of Munich, 1882; Ph. D., University of Munich, 1882; Assistant to Professor C. Kupffer, Munich, 1882–84; Assistant to Professor O. C. Marsh, Yale University, 1884–90.

Has been appointed Docent in Comparative Osteology and Paleontology, on which subjects he will lecture and conduct laboratory work.

LABORATORIES AND FACILITIES FOR WORK.

MORPHOLOGY.

The ROOMS occupied by the department of ANIMAL MORPHOLOGY are upon the third floor of the main building. The main laboratory is a large room, well lighted from the north side, and well adapted to microscopical research. It is furnished with large and commodious work-tables made from specially prepared designs, and with all the reagents, glassware, drawing-materials, etc., required in special work. The microscopes are made by Zeiss, and furnished with full sets of his apochromatic lenses and compensating eye pieces. Dissecting microscopes of the Zeiss–Mayer pattern, Thoma and Minot microtomes, water-baths, and other appliances necessary in biological investigation have also been supplied.

Five large aquaria, the largest being eight feet in length, have been placed in the laboratory. These are supplied with running water, making it possible to keep on hand during the winter a supply

of material for study and investigation. The numerous ponds in the vicinity of Worcester are convenient sources from which the aquaria may be stocked. Smaller glass aquaria, also supplied with running water, aoffrd opportunity for the rearing of special forms which are to be kept isolated.

THE LECTURE-ROOM, adjoining the main laboratory, is of convenient size, and is supplied with a full set of Leuckart & Nitsche's Zoölogical Charts, with a complete set of charts illustrating vertebrate embryology, and with Ziegler's Anatomical and Embryological wax-models. The nucleus of a collection of preserved specimens for lecture illustration has been provided, and a large number of specimens have been ordered from the Naples Zoölogical Station, which, with those already obtained, will form a collection containing representatives of all the principal groups of animals.

FOUR OTHER ROOMS, assigned to this department, serve as private laboratories for members of the staff.

ANATOMY.

A large room in the main building has been fitted up as an ANATOMICAL LABORATORY. It contains all the necessary apparatus required for histological and embryological research.

PHYSIOLOGY.

The PHYSIOLOGICAL LABORATORY consists of two large rooms, the one lighted by seven windows on the north the other by seven windows on the south side. In addition to these there is a room devoted to photography. There is an ample supply of gas and water, hoods and sinks. The furniture is solid and well suited to its purpose. It consists of cases for apparatus, and the multitude of small articles which are essential to every laboratory devoted to research; tables of various sizes and shapes, which are bracketed to the walls and hence freed from floor vibrations; and various articles designed for special uses.

The laboratory is well equipped with apparatus and instruments designed to measure and record physiological phenomena. Every piece was selected solely with reference to its usefulness in research work. In addition to these, there is an excellent supply

of tools for working metals, wood and glass. These are indispensable in a research laboratory, where every new problem presents new mechanical difficulties. The character of the apparatus will dpend on the nature of the work. The laboratory is not a museum and only such forms of apparatus will be purchased as are adapted to actual use. It is the intention to supply as far as possible every facility for research.

Investigations by Members of the Department of Biology.

Professor Whitman has published the following:

The Embryology of Clepsine. Quart. Journ. Micr. Sc. 1878. Preliminary report Zoölogischer Anzeiger, No. 1, 1878. Changes Preliminary to Cleavage. Prof. A. A. A. S., XXVII, 1878.

A Rare Form of the Blastoderm of the Chick, and its Bearing on the question of the Formation of the Vertebrate Embryo. Quart. Journ. Micr. Sc. XXIII, 1883.

The Flying Fish. American Naturalist, 1880.

Zoölogy in the University of Tokio. 1881.

Methods of Microscopical Research in the Zoölogical Station of Naples. Amer. Nat., 1882.

The Naples Zoölogical Station. Science, 1883.

A New Species of Branchiobdella. Zoölogischer Anzeiger, 1882.

A Contribution to the Embryology, Life-history, and Classification of the Dicyemids. Mittheilungen aus d. Zoöl. Station of Neapel. IV, 1883.

On the Development of some Pelagic Fish Eggs. Proc. Am. Acad. Arts and Sc. XX, 1884. [Joint work with Alexander Agassiz.]

The External Morphology of the Leech. Proc. Am. Acad. Arts and Sc. XX, 1884.

The Segmental Sense-organs of Leeches. Amer. Nat. 1884.

The Pelagic Stages of Young Fishes. Mem. Mus. Comp. Zoöl. XIV. 1885. [Joint work with Alexander Agassiz.]

Methods in Microscopical Anatomy and Embryology. Boston, 1885.

The Germ-layers of Clepsine. Zoöl. Anz. No. 218, 1886.

The Leeches of Japan. Quart. Journ. Mic. Sc. 1886.

Biological Instruction in Universities. Am. Naturalist, 1887.

The Kinetic Phenomena of the Egg during Maturation and Fecundation. Journ. Morph. 1887.

A Contribution to the History of the Germ-layers in Clepsine. Journ. Morph. 1887.

The Seat of Formative and Regenerative Energy. Journ. Morph. 1888.

Some New Facts about the Hirudinea. Journal of Morphology, 1889.

The Development of Osseous Fishes. II. The Pre-embryonic Stages of Development. Mem. Mus. Comp. Zoöl. 1889.

PART FIRST.—The History of the Egg from Fertilization to Cleavage.

PART SECOND, embracing Cleavage and the Formation of the Germ-ring, is in course of preparation.

DR. LOMBARD

Is the author of the following researches in his department:

Beiträge zur Theorie der Wärmcempfindung. Vorläufige Mitteilung. Centf. d. Med. Wis. 1883, No. 32.

Die räumliche und zeitliche anfeinanderfolge reflectorisch contrahirter Muskeln. Arch. f. Anat. u. Physiol., 1885, p. 408.

Is the 'Knee-jerk' a Reflex Act? Amer. Jour. of the Medical Sciences. Jan., 1887, p. 88.

The Variations of the Normal 'Knee-jerk.' Amer. Jour. of Psychol. Oct., 1887. Translation of the above—"Die Variationen des normalen Kniestosses." Arch. f. Anat. u. Physiol. Supplement band, 1889, p. 292.

On the Nature of the "Knee-jerk." Jour. of Physiol. Vol. X, No. 1 and 2, p. 122.

The Effect of Fatigue on Voluntary Muscular Contraction. Amer. Jour. of Psychol. Jan., 1890. Translation of the above to appear in the next number of the Archiv. Italiennes de Biologie.

The results which have been obtained from the investigations which have been made in this department, will be published in due time. As much of this work is still in progress, it is undesirable to make a more explicit statement.

Under Dr. Lombard's direction,

DR. CARDWELL

Has been studying experimentally the physiology of the cerebellar cortex in cats and dogs, the results of which are not yet in proper form for publication.

DR. MALL

Is the author of the following researches, among many others, in his department:

Entwickelung der Branchialbogen und -Spalten des Hünschens. His und Braune, Archiv. 1887. Blut-und Lymphwege in Dünndarme des Hundes. Abhandl. der K. Säch. Ges. d. Wiss., Bd. xiv.

Development of the Ear of the Chick. Studies from the Biolog. Lab. J. H. U., 1888.

The Bronchial Clefts of the Dog. Studies from the Biolog. Lab. J. H. U., 1888.
Reticulated and Yellow Elastic Tissues. Anatomischer Anzeiger 1888.

DR. MALL has, during the present academic year, had the following subjects under investigation. Some of the results will soon be published.

1. The connective tissue fibrils.
2. Reconstruction of a human embryo, 26 days.
3. The histology of the lung.
4. The development, architecture and structure of the liver lobule.
5. Suture of the intestine.

Under the direction of Dr. Mall, DR. GAGE has been occupied with an investigation of the anatomy of the intestines; also

DR. MILLER has been engaged in an investigation upon the ending of the Bronchi and the relation of the arteries and veins to the Bronchi and air cells. Good progress has been made, and several new points have been brought out. Work will be continued in this line for some time to come. The University has furnished every facility for the carrying out of this work, and many fine preparations are the result. These are corrosions of the different sets of vessels in both wax and metal. More are to be made soon.

DR. MCMURRICH has published the following papers:

On the origin of the so-called Test-cells in the Ascidian ovum—Studies from the Biolog. Lab. Johns Hopkins Univ. Vol. II, 1882. (Abstract in Biolog. Centralblatt II, 1882; Arch. de Zool. exp. et gén., X, 1882.)

Note on the function of the "test-cells" in Ascidian ova—Zoölog. Anzeiger V, 1882. (Abstract in Journ. Roy. Micros. Soc. II, 1882.)

On the Osteology and development of Syngnathus Peckianus (Storer)—Quart. Journ. Micr. Sci. XXIII, 1883. (Abstract in Johns Hopkins University Circular No. 27, 1883.)

The osteology and myology of Amiurus catus (L) Gill—Proceedings of the Canadian Institute, Toronto. N. S. Vol. II, 1884. (Preliminary notice in Zoölog. Anzeiger VII, 1884.)

On the structure and affinities of Phytoptus—Johns Hopkins University Circular, No. 35, 1884. (Abstract in Journ. Royal Micros. Soc. V, 1885.)

On the Tape-worm Epizootic among Lambs (Taenia expansa)—Ninth Annual Report of the Ontario Agricultural College, Toronto, 1884.

The cranial muscles of Amia calva (L), with a consideration of the Post-oc-

cipital and Hypoglossal nerves in the various vertebrate groups—Studies from the Biolog. Lab. Johns Hopkins University, Vol. III, 1885. (Preliminary notice in Johns Hopkins University Circular, No. 38, 1885.)

On the existence of a post-oral band of cilia in Gasteropod Veligers—Johns Hopkins University Circulars, No. 43, 1885. (Abstract in Journ. Royal Micros. Soc., Vol. VI, 1886.)

A contribution to the Embryology of the Prosobranch Gasteropods—Studies from the Biolog. Lab. Johns Hopkins University, Vol. III, 1886. (Preliminary notice in Johns Hopkins University Circulars, No. 49, 1886; abstract in Journ. Royal Micros. Soc., VI, 1886.)

Notes on the Actiniæ obtained at Beaufort, N. C.—Studies from the Biolog. Lab. Johns Hopkins University, Vol. IV, 1887.

On the occurrence of an Edwardsia stage in the free-swimming embryos of a Hexactinian—Johns Hopkins University Circulars, No. 70, 1889. (Abstract in Journ. Royal Micros. Soc., IX, 1889.)

A contribution to the Actinology of the Bermudas—Proceedings of the Acad. of Nat. Sciences, Philadelphia, 1889. (Abstract in Journ. Royal Micros. Soc., IX, 1889.)

Note on the structure and systematic position of Lebrunea neglecta, Duch. and Mich.—Zoölog. Anzeiger XII, 1880. (Abstract in Journ. Royal Micros. Soc. IX, 1889.)

Article "Reproduction" in Buck's Reference Handbook of the Medical Sciences, Vol. VIII, 1889.

The Actiniaria of the Bahama Islands, W. I.—Journal of Morphology, Vol. III, 1889. (Abstract in Journ. Royal Micros. Soc. Vol. X, 1890; American Naturalist, 1889; Preliminary notice in Johns Hopkins University Circulars, No. 70, 1889.)

A paper entitled "Contributions on the Morphology of the Actinozoa. I. The structure of Cerianthus Americanus" will shortly be published in the Journal of Morphology.

Papers on the Actiniæ obtained by the U. S. Fish Commission Steamer 'Albatross' during the winter of 1887-8, and on the Embryology of the Actiniæ are also well under way.

Dr. Tuckerman has published the following papers:

Some Observations in Reference to Bilateral Asymmetry of Form and Function.—Journ. Anat. Phys., Vol. XIX, 1885; Nature, 1885.

Supernumerary Leg in a Male Frog (Rana palustris).—Journ. Anat. Phys., Vol. XX, 1886. Plate.

The Tongue and Gustatory Organs of Mephistic mephitica.—Quart. Journ. Micr. Sci., Vol. XXVIII, N. S., 1887. Plate.

The Tongue and Gustatory Organs of Fiber Zibethicus. Journ. Anat. Phys., vol. xxii, 1888. Plate.

Note on the Papilla foliata and other Taste Areas of the Pig. Anat. Anzeiger, Jahrg. iii, 1888.

An interesting specimen of Tænia saginata. Zoölog. Anzeiger, Jahrg. xi, 1888.

The Anatomy of the Papilla Foliata of the Human Infant. Journ. Anat. Phys., Vol. xxii, 1888. Plate.

Antipyrine in Cephalalgia. N. Y. Med. Record, 1888.

Observations on the Structure of the Gustatory Organs of the Bat, (Vespertilio subulatus.) Journ. of Morph., Vol. ii, 1888. Plate.

Supplementary Note on Taenia saginata. Zoölog. Anzeiger, Jahrg. xi, 1888. Figures.

Anthropometric Data Relating to Students of the Massachusetts Agricultural College, Amherst, 1888.

On the Gustatory Organs of Putorius vison. Anat. Anzeiger, Jahrg. iii, 1888.

On the Gustatory Organs of Vulpes vulgaris. Journ. Anat. Phys., Vol. xxiii, 1889.

On the Gustatory Organs of Arctomys monax. Anat. Anzeiger, Jahrg. iv, 1889.

On the Development of the Taste-Organs of Man. Journ. Anat. Phys., Vol. xxiii, 1889.

On the Gustatory Organs of Sciurus carolinensis. The Microscope, Vol. ix, 1889. Plate.

On the Gustatory Organs of Erethizon dorsatus. Amer. Monthly Mico. Journ., Vol. X, 1889.

An undescribed Taste Area in Perameles nasuta. Anat. Anzeiger, Jahrg. iv, 1889. Figure.

On the Gustatory Organs of the American Hare, Lepus Americanus. Amer. Journ. Sci., Vol. xxxviii, 1889.

Note on the Tongue of Chrysotis aestiva. The Microscope, Vol. ix, 1889.

The Gustatory Organs of Belideus ariel. Journ. Anat. Phys., Vol. xxiv, 1889. Plate.

Further Observations on the Development of the Taste-Organs of Man. Journ. Anat. Phys., Vol. xxiv, 1889.

The Gustatory Organs of Procyon lotor. Journ. Anat. Phys., Vol. xxiv, 1890. Plate.

On the Gustatory Organs of Sciurus hudsonius. The Microscope, Vol. x, 1890. Plate.

On the Gustatory Organs of the Mammalia. Proc. Bost. Soc. Nat. Hist., Vol. xxiv, 1890.

On the Gustatory Organs of some Edentata. Interna. Monatssch. f. Anat. u. Phys., Vol. vii, 1890.

On the Gustatory Organs of some of the Mammalia. Journ. Morph., vol. iv, 1890.

Other papers are in course of preparation, including a work on the comparative histology of the organs of taste of the mammalia. He has been at work upon the comparative anatomy of the taste-organs of the Marsupialia, Edentata, Rodentia, Insectivora, Chiroptera, Ungulata, Carnivora, Inadonmana, and

other mammals, and the results are now being prepared for publication.

Mr. H. C. Bumpus has printed:

"Studies in Zoölogy."—American Teacher, 1886.

"Reptiles and Batrachians of Rhode Island."—Random Notes on Natural History, Vol. II, III, '85-'86.

"Reptilia," in Standard Nat. History, Vol. III, '85.

"An inexpensive self-registering anxanometer."—Botanical Gazette, Vol. XII, 1887.

He has spent the year in research upon the embryology of Crustacea, especial attention having been given to the American lobster. The first part embracing the cleavage of the ovum, and the germ layer, is nearly ready for publication.

Dr. Baur has published as follows:

Der Tarsus der Voegel und Dinosaurier, eine morphologische Studie. Morph. Jahrbuch, vol. viii, 1882. pp. 417-456, 2 pl. Also separate, as Inaugural Dissertation.

Der Carpus der Paarhufer. Eine morphogenetische Studie. Morph. Tahrbuch, vol. ix, 1884. pp. 597-603.

Dinosaurier und Voegel. Eine Erwiederung au Herrn Prof. W. Dames in Berlin. Morph. Jahrbuch, vol. x, 1885. pp. 446-454.

Bemerkungen ueber das Becken der Voegel und Dinosaurier. Morph. Jahrbuch, Bd. x, 1885. pp. 613-616.

The same Amer. Naturalist. Dec. 1884. pp. 1273-1275.

Zur Morphologie des Tarsus der Säugethiere. Morph. Jahrb., vol. x, 10, 1885. pp. 458-461. The same, Amer. Naturalist, Jan., 1885. pp. 87-88.

Ueber das Centrale carpi der Säugethiere. Morph. Tahrb., vol. x, 1885. pp. 455-457. The same, Amer. Naturalist., Feb., 1885. pp. 195-196.

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A complete Fibula in an adult living Carinate Bird. Science, May 8, 1885. p. 375.

On the Morphology of the Carpus and Tarsus of the Vertebrates. Amer. Naturalist, July, 1885. pp. 718-720.

Zur Morphologie des Carpus und Tarsus der Wirbelthiere. Zoölog. Anz., No. 196, 1885. pp. 326-329.

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Wirbelthiere. (Zoöl. Anz., 1885, No. 196). Zoöl Anz., No. 202, 1885. pp. 486–488.

Zum Tarsus der Voegel. Zoöl. Anz., No. 202, 1885. p. 488.

"Note on the Sternal Apparatus in Iguansdon." Zoöl. Anz., No. 205, 1885. pp. 561–562.

Einige Bemerkungen über die Ossification der "langen" Knochen. Zoöl. Anz. 206, 1885. pp. 580–581.

Bemerkungen über den "Astragalus" und das Intermedium tarsi der Säugethiere. Morph. Jahrb., vol. ii, 1885. pp. 468–483, 1 pl.

Zur Morphologie des Carpus und Tarsus der Reptilien. Zoöl. Anz., No. 208, 1885. pp. 631–638.

Über das Archipterygium und die Entwicklung des Cheiropterygium aus dem Ichthyopterygium. Zoöl. Anz., No. 209, 1885. pp. 663–666.

Preliminary note on the Origin of Limbs. Amer. Natur., Nov., 1885. p. 1112.

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The Intercentrum of living Reptilia. Amer. Natur., Feb., 1886. p. 174.

The Proatlas, Atlas and Axis of the Crocodilia. Am. Nat., March, 1886. pp. 288–293. (Woodcuts).

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Herrn Professor K. Bardeleben's Bemerkungen über "Centetes madagascariensis." Zoöl. Anz., No. 220, 1886. pp. 219–220.

Über die Kanalde im Humerus der Amnioten. Morph. Jahrb., 1886. pp. 299–305.

Bemerkungen über Sauropterygia und Ichthyopterygia. Zoöl. Anz., No. 221, 1886. pp. 245–252.

Über das Quadratum der Säugethiere. Gesellsch. fur Morphol. und Phys. Munchen, 1886. pp. 45–57. The same, Biol. Centralbl., vi, 1886, pp. 648–658; and Quart. Journ. Microsc. Science, 1887. pp. 169–180. Translated by Wm. B. Benham.

Über die Morphogenie der Wirbelsäule der Amnioten. Biol. Centralblatt, vol. vi, No. 11 and 12, 1886. pp. 332–342; 353–363.

The Intercentrum in Sphenodon (Hatteria). Amer. Nat., May, 1886. p. 465.

Berichtigung. Zoöl. Anz., No. 223, 1886. p. 323.

The Ribs of Sphenodon (Hatteria). Amer. Nat , Nov., 1886. pp. 979–980.

Über die Homologien einiger Schaedelknochen der Stegocephalen und Reptilien. Anat. Anz., 1886, No. 13. pp. 348–350.

Osteologische Notizen über Reptilien. Zoöl. Anz., No. 238, 1886. pp. 685–690.

Osteologische Notizen über Reptilien, Fortsetzung I. Zoöl. Anz., No. 240, 1886. pp. 733–743.

On the Morphogeny of the Carapace of the Testudinata. Am. Nat., Jan., 1887. p. 89.

Osteologische Notizen über Reptilien, Fortsetzung II. Zoöl. Anz., No. 244, 1887. pp. 96–102.

Erwiederung an Herrn Dr. A. Guenther. Zoöl. Anz., No. 245, 1887. pp. 120–121.

Über Lepidosiren paradoxa Fitzinger. Zoöl. Jahrbucher, vol. ii, 1887. pp. 575–583.

Nachtraegliche Notiz zu meinen Bemerkungen. "Über die Homologieen einiger Schaedelknocken der Stegocephalen und Reptilien," in Nr. 13 des ersten Jahrganges dieser Zeitschrift. Anat. Anz., No. 21, 1887. pp. 657–658.

On the Phylogenetic Arrangement of the Sauropsida. Journ. of Morphology, vol. i. 1887. pp. 93–104.

Über die Abstammung der Amnioten Wirbelthiere. Gesellsch. f. Morphologie and Phys. Munchen, 1887. pp. 46–61. The same, Biol. Centralbl., vol. vii, 1887. pp. 481–493.

On the Morphology and Origin of the Ichthyopterygia. Amer. Natur., Sept., 1887. pp. 837–840.

On the Morphology of Ribs. Amer. Natur., Oct., 1887. pp. 942–945.

Beiträge zur Morphogenie des Carpus und Tarsus der Vertebraten. I. Theil, Batrachia. Jena, 1888. p. 86, 3 pl.

Über den Ursprung der Extremitäten der Ichthyopterygia. Bericht. xx, Vers. Oberrhein. Geol. Ver. Stuttgart, 1888. pp. 17–20, 1 pl.

Dermochelys, Dermetochelys, oder Sphargis. Zool. Anz., No. 270 1888. pp. 44–45.

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Notes on the American Trionychidæ. Amer. Natur., Dec., 1888. pp. 1121–1122.

The Theory of the Origin of Species by Natural Selection. Amer. Natur., Dec., 1888. p. 1144.

Osteologische Notizen über Reptilien. Fortsetzung III. Zoöl. Anz., No. 285, 1888. pp. 417–424.

Osteologische Notizen über Reptilien. Fortsetzung IV. Zoöl. Anz., No. 291, 1888. pp. 592–597.

Osteologische Notizen über Reptilien. Fortsetzung V. Zoöl. Anz., No. 296, 1888. pp. 736–740.

Osteologische Notizen über Reptilien. Fortsetzung VI. Zoöl. Anz., No. 298, 1889. pp. 40–47.

Revision meiner Mittheilungen im Zoologischen Anzeiger mit Nachtraegen. Zoöl. Anz. No. 306, 1889. pp. 238–243.

Neue Beitraege zur Morphologie des Carpus der Säugethiere. Anat. Anz. 1889. No. 2. pp. 49–51 4 fig.

The systematic Position of Meiolania. Owen. Ann. and Mag. Nat. Hist. Jan. 1889. pp. 54–62.

On Autacochelys Lydeker, and the Systematic Position of Anosteira, Seicly, and Pseudotrionyx, Dollo. Ann. Mag. Nat. Hist. Mar. 1889. pp. 273–276

On Meiolania and some points in the osteology of the Testudinata; a reply to Mr. G. A. Boulenger. 1 Pl. Ann. Mag. Nat. Hist. July 1889. pp. 37–45.

Mr. E. T. Newton on Pterosauria. Geol. Magaz. April 1889. pp. 171–174.

Die Systematische Stellung von Dermochelys, Blainv. Biol. Centralbl. 1889. No. 5 and 6. pp. 149–153, 180–191.

Nachtraegliche Bemerkungen über die Systematische Stellung von Dermochelys, Blainv. Biol. Centralbl. 1889. No. 20 and 21. pp. 617-619.

Palaeohatteri Credner, and the Proganosauria. Amer. Journ. Science. April 1889. pp. 310–313.

Kadaliosamus priscus credner, a new Reptile from the Lower Permian of Saxony. Am. Journ. Sci. Feb. 1890. pp. 156–158.

Bemerkungen uber den Carpus der Probiscidier und der Ungulaten im Allgemeinen. Moph. Jahrb. Vol. XV. 1890. pp. 478–482. 1 fig.

On the morphology of ribs and the fate of the Actinosis of the Median Fins in Fishes. Journ. of Morph. Vol. III. 1889. pp. 463–466. (fig)

On the Morphology of the Vertebrate Skull. Journ. of Morphol. Vol. III. 1889. pp. 467–474.

A Review of the Charges Against the Paleontological Department of the U. S. Geological Survey, and of the Defence made by Prof. O. C. Marsh. Amer Nat. March 1890. pp. 298–304.

V.

PSYCHOLOGY.

Work of the Past Year.

Instruction in this department has been given by

G. Stanley Hall, Ph. D., Temporary Professor of Psychology.

H. H. Donaldson, Ph. D., Assistant Professor of Neurology.

E. C. Sanford, Ph. D., Instructor in Experimental Psychology.

F. Boas, Ph. D., Docent in Anthropology.

A. MacDonald, Ph. D., Docent in Practical Ethics.

B. C. Burt, A. M., Docent in The History of Philosophy.

A. Cook, Ph. D., Docent in History of Philosophy and Ethics.

C. F. Hodge, Ph. D., Fellow in Psychology.

The President of the University was appointed temporary Professor of Psychology, but, owing to the pressure of official duties, has been able to give but comparatively little instruction.

A.—NEUROLOGY.

Assistant Professor Donaldson has lectured through the year on the Anatomy of the Central Nervous System in Man. These lectures were illustrated by the exhibition of specimens, models, and the works of the principal investigators.

A seminary, meeting once a week, has devoted a dozen sessions to the consideration of localization in the central nervous system, viewing the subject historically.

B.—EXPERIMENTAL PSYCHOLOGY.

Dr. Sanford held informal weekly conferences during the first few weeks. In November he began a detailed course of lectures on Reaction-Times, treating first the physiological part of the pro-

cess of reaction (rate of nervous conduction in sensory and motor nerves, latency of the stimulus in the sense organs, etc.), then the more distinctly psychophysical parts (sensory and motor forms of reaction, effect of intensity and place of stimulus, of attention, of complicating the stimulus or response, "personal equation," etc.), and finally considering the time relations of mental associations. Methods of experiment were explained, and demonstrations made in connection with this course. In March, Dr. Sanford began a course of lectures upon the Color Sense, with special reference to Helmholtz and Hering. The remainder of the year was devoted to Binocular Vision. Each course has been copiously illustrated by demonstrations.

Dr. Sanford has also directed the demonstrational and research work in the psychological laboratory, and has acted as publisher of the *American Journal of Psychology*, which is edited by Dr. G. S. Hall.

C.—ANTHROPOLOGY.

Dr. Boas has given two courses of lectures, one upon the Anthropology of North America.

In this course of lectures the distribution, physical characters, languages, inventions, customs and beliefs of the various tribes were taken up in succession, beginning in Arctic America and proceeding southward along the Pacific Coast after which the tribes east of the Rocky Mountains were treated. Particular stress was laid on the diffusion of cultural elements all through North America. A second course of lectures "on Methods of Anthropological Investigation" was intended to serve as an introduction into the subject. The methods of describing and measuring skeletons and living individuals formed the subject of the lectures until Christmas. In this course the use of anthropological apparatus was explained. Later on, the subjects of language, social institutions, religion, and customs were treated briefly in this order.

In the anthropological laboratory two courses, each of two hours weekly were held. The first of these had for its object an introduction into the methods of field investigation. Anthropome-

try and language were the principal subjects taught. The second course related to anthropometry especially to craniometry.

In the months of March and April a seminary on "Shamanism" was held. The practices of the "medicine men" were described and discussed and compared with the magic of the middle ages. The abnormal states of mind, forming part and parcel of the shamanistic rites were treated and the connection between trances, hallucinations, hypnotism and allied states, was pointed out. Finally various theories of shamanism were discussed.

D.—PRACTICAL ETHICS, (Criminology.)

Dr. MacDonald—Docent in practical Ethics, has devoted his entire time this year to the subject of criminology. His lectures have treated crime from the standpoints of Anatomy, Psychology, Sociology, Statistics, Prophylaxy and Teratology. The standpoint of the lecturer has been that as mental diseases may be utilized by the student of Psychology as nature's experiments in his field, so crime may be studied as the most objective way of approaching the great problems of right, duty and freedom of choice.

E.—PHILOSOPHY.

Mr. Burt has conducted courses in the history of Philosophy throughout the year. In connection with his lectures upon Greek Philosophy a seminary was held for the critical reading and study of Platonic Dialogues, twelve of which were completed. Here the attempt was made to understand not only the Dialogues themselves but the psychologic development of Plato's conceptions with special reference to the modern theories of that development. A few meetings the last of the year were devoted to Aristotle's metaphysics and particularly the Categories. In general it was sought to present the field of ancient philosophy in a way to make clear how fundamental is the necessity of studying modern conceptions of philosophy, religion and science in their fresh original fulness among the ancient Greeks in order to understand them.

Mr. Burt also gave during the latter part of the year a course of lectures upon the modern Philosophy before Kant.

Dr. Cook has devoted the year to the history of modern philosophy from Kant to Locke, both included. He has attempted a genetic history of philosophy as distinct from its chronological unfoldment. His standpoint is mainly that of Kant.

Work of Next Year.

DR. HALL. PSYCHOLOGY AND EDUCATION.

Dr. Hall will direct next year the work of a few special students in both Psychology and Education. His special announcements will be made later.

DR. DONALDSON. NEUROLOGY.

The work of next year will be in the direction of further research along neurological lines, seminary work on some selected subjects, and lectures and demonstrations on the anatomy of the central nervous system and sense organs—the precise form of which will be determined by the needs of those students who present themselves in the fall.

DR. SANFORD. EXPERIMENTAL PSYCHOLOGY.

Next year Dr. Sanford will first lecture upon the Psychology of Hearing, Taste, Smell and Touch. Later in the year he will lecture upon the Psycho-Physic law and upon the experimental treatment of Memory, Attention, etc. Demonstrations will be given as important a place as possible.

DR. BOAS. ANTHROPOLOGY.

Dr. Boas will, during the next year, give the following courses:

1. Physical Anthropolgy, Osteology, particularly craniology. Physical character in the living subject. Anatomy of races.

In connection with the course of lectures, practical work on methods of studyng the anatomy of races will be conducted in the anthropological laboratory.

2. Anthropology of Africa. Geographical distribution, physical characters, languages and culture of the native tribes of Africa.

In the spring a special course of lectures will be given on "American Myths."

WILLIAM H. BURNHAM, Ph. D., Docent in Pedagogy.

A. B., Harvard University, 1882; Fellow Johns Hopkins University, 1885–86, and Instructor, 1888–89; Ph. D., 1888.

Will lecture and conduct seminary work on the History and Methods of Education. A detailed announcement of these courses will be made later.

FACILITIES.

The NEUROLOGICAL LABORATORY consists of one large room (21 x 40 ft.) and one smaller room, which have been furnished and equipped for this work alone. It is under the direction of DR. DONALDSON, assisted by DR. C. F. HODGE. It affords all needed facilities for verification and investigation in the field of Neurology, and is well furnished with apparatus for histological work. It contains also a good equipment of illustrative apparatus, such as a model of the human brain, by Aeby; a large dissectible brain, medulla and cord, by Auzou; Ziegler's models of animal brains, etc. The collection of Neurological literature, both current and historical, is unusually extensive.

The PSYCHOLOGICAL LABORATORY has been apportioned a suite of rooms on the second floor, consisting of one large and two small rooms. The large room is used as a general laboratory and lecture room; one of the smaller rooms is used by the instructor as an office and as a room in which the subject may be placed in reaction-time experiments to avoid the sound of the chronoscope. During the past year by the courtesy of Dr. Lombard the physiological laboratory has been used for psychological work of special kinds.

The department is well supplied with apparatus for time measurements and psychological optics. There are now in the laboratory or in construction (for the first purpose): The Hipp chronoscope with its various appliances, the Wundt chronograph for very small intervals, the Cattell fall-chronometer, a pendulum myograph, Bowditch's neuromoebimeter, Wundt's time-sense apparatus, Wundt's apparatus for presentation of simultaneous stim-

uli, " personal equation" machine of Eastman after a model in the National Observatory, several pendulums constructed in the laboratory for special purposes, revolving drum, time-markers, Koenig's forks, etc. For psychological optics: Large disk color-mixer of Krille, small color mixer with horizontal disk by Rothe of Prag, such as was used by Dr. Hess in his recent studies of color vision in the indirect field. Holmgren's chromatoskiameter, Priestly Smith's perimeter, Donder's Horopterscope, Phaenophthalmotrope of Donder's, Snellen's phakometer, tests for color blindness, ophthalmotrope, ophthalmoscope Kühne's model of the eye, instruments used by Drs. Hall and Bowdich in studying visual illusions of motion, stereoscopes, test lenses, etc., etc.

Of apparatus for other purposes the laboratory has: A large induction coil for sparks, Du Bois–Reymond sliding induction coil, electric motor, harmonical (devised by Ellis for study of tone on principles of Helmholtz) with set of carefully tested tuning forks, most of Galton's anthropometric apparatus, aesthesiometric compasses, laryngoscope, apparatus for mapping heat and cold spots on the skin, Mosso's bed, batteries, etc., etc. The laboratory has been open during the year for those who, while giving other work their chief attention, desire to learn something at first hand of psycho-physic apparatus and its use in the standard experiments, and for those carrying on original research in psychological lines.

The ANTHROPOLOGICAL DEPARTMENT has two rooms fitted up with craniometric and anthropological journals and is well provided with books on anthropological subjects. In the laboratory opportunity is offered to become acquainted with the use of anthropological instruments and with the application of anthropological methods. Original investigations were carried on by Dr. Boas on material collected on the North Pacific Coast.

STUDIES BY MEMBERS OF THE DEPARTMENT OF PSYCHOLOGY.

DR. G. S. HALL has published as follows:

EXPERIMENTAL.

The Perception of Color." Proc. Am. Acad., Arts and Sci., March, 1878.
Laura Bridgman." Mind, April, 1879.

Ueber die Abhangigkeit der Reactionszeiten vom Ort des Reizes with Dr. Kries. Archir für Anat. und Physiol., 1879.

Die willkürliche Muskelaction with Professor Kronecker. (Ibid, 1879)

The Muscular Perception of Space. Mind, 1879.

Hegel: His Followers and Critics. Journal of Speculative Philosophy, 1880.

Optical Illusions of Motion with Professor H. P. Bowditch. Jour. of Physiol., Vol. III, No. 5.

Contents of Children's Minds. Princeton Review, May, 1883.

Bilateral Asymmetry of Function with E. M. Hartwell. Mind, No. 33.

Reaction Time and Attention in the Hypnotic State. Mind, No. 30.

Studies of Rhythm. Mind, Vol. XI, No. 41.

Motor Sensations of the Skin, with Dr. H. H. Donaldson. Mind, No. 40.

Dermal Sensitiveness to Gradual Pressure Changes. Am. Jour. of Psychol., 1887.

Other contributions to the American Journal of Psychology, of which he is Editor.

Educational.

Philosophy in the United States. Pop. Sci. Monthly, Supp., No. 1, 1879.

Moral and Religious Training of Children. Princeton Review, Jan., 1883.

The Education of the Will. Princeton Rev., Nov., 1882.

The New Psychology. Opening Lecture, Johns Hopkins University, Fall of 1884. Andover Review, March and May, 1885.

How to Teach Reading and What to Read in Schools. D. C. Heath, Boston, 1887.

Bibliography Education with J. M. Mansfield. Book of 300 pp., Ginn & Co., Boston, 1886.

New Departure in Education. N. A. Review, Feb., 1885.

Aspects of German Culture. Book of 318 pp., Osgood, Boston, 1881.

Methods of Teaching History. Editor, Book of 385 pp., Boston, 1885.

A Sand Pile. Scribner's Mag., Jan., 1888.

Children's Lies. Am. Jour. of Psychol., Jan., 1890).

Many Educational Addresses.

Several other articles and studies are either ready for publication, or under way.

Dr. Donaldson is author of the following researches:

On the Detection and Determination of Arsenic in Organic Matter. [Under Prof. R. H. Chittenden.] Am. Chemical Journal Vol. II, No. 4.

The Influence of Digitaline on the Work of the Heart and on the Flow through the Blood-vessels. [With Dr. L. T. Stevens.] Jour. of Physiology, Vol. IX, No. 2.

Motor Sensations of the Skin. [Under G. Stanley Hall.] Mind, No. XL.

On the Temperature-Sense. Mind, No. XXXIX.

On the Relation of Neurology to Psychology. Am. Journal of Psychology, Vol. I, 1888.

Investigations have been conducted on the physiology and anatomy of nerve cells in the spinal ganglia; on the relations between the growth of a limb and the growth of the nerve centers and the nerve connected with it; and on the histology of the cerebellar cortex. A description of the brain of the blind deaf-mute, Laura Bridgman, has been begun.

Dr. C. F. Hodge has presented several special papers and lectures on the physiology of the nervous system. He is engaged upon a research concerning the morphological modifications found in nerve cells as a result of stimulation. He is also writing the History of Reflex Action, and has been preparing an extensive series of microscopic specimens to illustrate the anatomy of the central nervous system.

Dr. Sanford is author of the following original studies:

The Writings of Laura Bridgman, two articles in the Overland Monthly, 1886–7.
The Relative Legibility of the Small Letters. Am. Jour. of Psy., May, 1888.
Personal Equation. Three articles in the Am. Jour. of Psy., Nov., 1888; Feb. and May, 1889.

The following points have been made the subject of investigation by Dr. Sanford: 1. Is reaction quicker when the stimulus is received in the reacting hand, or in the other? 2. Is reaction-time modified by the number of muscles brought into action? 3. Determination of the numerical index of force exerted by more or less complex concepts on the simple sensations which call them up. 4. Theoretical construction of a new chronoscope.

Mr. Herbert Nichols has been engaged upon a successful research on the determination, measurement, and physiological location of certain phenomena of time-sense, particularly with reference to apparently conflicting results between German and American investigators.

Dr. Boas is the author of the following studies:

Beiträge zur Erkenntniss der Farbe des Wassers. Inaugural-Dissertation, Kiel, 1881.
Ein Beweis des Talbotschen Satzes. Ann. der Phys. und Chem., 1882, p. 359–362.
Über eine neue Form des Gesetzes der Unterschiedsschwelle. Pflüger's Archiv., 1881, p. 493—500.

Ueber die verschiedenen Formen des Unterschiedsschwellenwerthes. Ibid. 1882, p. 214–222.

Die Bestimmung der Unterschiedsempfindlichkeit nach der Methode der richtigen und falschen Fälle. Ibid, 1882, p. 84–94.

Die Bestimmung der Unterschiedsempfindlichkeit nach der Methode der übermerklichen Unterschiede, 1882, p. 562–566.

Über den Unterschiedsschwellenwerth als Maass der Intensität psychischer Vorgänge. Philos. Monatshefte, 1882, p. 367–375.

Die Grundaufgabe der Psychophysik. Pflügers' Archiv, 1882, p. 566–576.

Ueber die ehemalige Verbreitung der Eskimo im Arktisch Amerikanischen Archipel. Ztsch. Ges. der Erdk. Berlin, 1883, p. 118–136.

Baffinland, Geographische Ergebnisse einer in den Jahren 1883 und 1884 unternommenen Forschungsreise, Gotha. Justus Perthes, 1885, p. 1–100.

Bemerkungen zur Topographie der Hudson Bay und Hudson Strasse. Pet. Mitt., 1885, p. 424–426.

Die Sprache der Bella Coola Indianer. Verh. Anthr. Ges. Berlin, 1886, p. 202–206.

Zur Ethnologie von Britisch Columbien. Pet. Mitt. 1887, No. 5.

Mitteilungen über die Vilqula Indianer. Original Mitteilungen Mus. für Völkerkunde, Berlin.

Notes on the Ethnology of British Columbia. Proc. Am. Phil. Soc. 1887, p. 422–428.

Census and Reservations of the Kwakiutl. Bull. Am. Geogr. Soc., 1887.

On Certain Songs and Dances of the Kwakiutl. Journ. Am. Folk-Lore, 1888, p. 49–64.

Die Mythologie der nordwestamerikanischen Küstenstämme. Globus, 1887–88.

Bericht über die Fortschritte der Erforschung Nord-Amerikas. Behm und Wagner's Geogr. Jahrbuch, XII, p. 73–104.

Meteorologische Beobachtungen im Cumberland Sunde. Ann. der Hydr., 1888, p. 241–262.

Myths and Legends of the Çatloltq. Am. Antiquarian, 1888, p. 201–211.

The game of Cat's Cradle, Int. Archiv für Ethnogr. 1888.

Chinook Songs. Journ. Am. Folk-Lore, 1888, p. 220–226.

Sagen der Eskimo von Baffinland. Verh. Ges., Berlin, 1888, p. 394-405.

Die Tsimschian, Ztschr. für Ethn., 1888, p. 231–247.

The study of Geography, Science, 1887, p. 137.

The Central Eskimo. Sixth Annual Rep. Bur. of Ethn., p. 399 669.

The Houses of the Kwakiutl Indians. Proc. U. S. Nat. Mus. 1888, p. 123–131.

Notes on the Snanaimuq. Am. Anthr. 1889, p. 321–328

The Indians of British Columbia. Trans. Roy. Soc. of Can., 1888, II, p. 47–57.

Fourth Report of the Committee of the British Association for the Advancement of Science, on the Northwestern Tribes of Canada, p. 1–10.

Fifth Report of the same Committee, p. 1–96.

On Alternating Sounds. Am. Anthr., 1889, p. 47–53.

The Development of the Culture of Northwest America. Science, XII, p. 194.

On the use of masks and head ornaments on the northwest coast of America Internat. Arch. für, Ethnogr. 1890.

DR. BOAS completed a monograph of the mythologies of the North Pacific coast and carried on researches on the anthropology of the same tribes based on material collected on several journeys.

DR. MCDONALD has commenced several lines of investigation upon criminals, including anthropometric, psychical and anamnestic and other examinations. While attempting a scientific study of criminals, the broader philosophical aspects of the ethical problems in this field are no less carefully and fully considered.

DR. HODGE has printed the following papers:

Some Effects of Stimulating Ganglion Cells, Prelim. Comm. Am. Jour. Psy., May, 1888.

Some Effects of Electrically Stimulating Ganglion Cells.—Am. Jour. Psychology, May, 1889.

A study of the oyster beds of Long Island Sound, with reference to the ravages of Star-fish.—Johns Hopkins Circular, 1889.

The next step in the study of nerve cell stimulation, viz., with reference to the behavior of the cells after exhaustion, has been taken; and results have been obtained to show that nerve cells, like gland cells in general, tend to return to normal after stimulation. Work upon the minute structure of the spinal ganglia of shark and frog has also been continued throughout the year.

MR. BURT.

"Brief History of Greek Philosophy." (Ginn & Co., Boston.)

Translation of "Erdmann's History of Philosophy from Kant to Hegel." (Swann, Sonnenschein & Co.)

"Shakespeare in the opinion of the 17th Century." New Englander, 1881.

"Watson's Kant and His English Critics." Unitarian Review 1882.

Series of Articles on "Greek Philosophy." Unity, Chicago, 1884–85.

"Some Relations between Philosophy and Literature." Pub. of Philos. Soc., Michigan University, 1886.

"Philosophical Works of Professor George S. Morris." Chronicle, 1889.

"German Philosophy Since Hegel." Education, April and May, 1890.

"References for Students in English Literature." Pamphlet, 1887.

Mr. Burt is now engaged in writing a history of Modern Philosophy.

DR. COOK has written:

Ueber die Beckeleyesche Philosophie.

"Natural Law and Free-will, a Dissertation on the Kantian Philosophy."

Dr. Cook is engaged on a Treatise in the field of Psychology.

Mr. Dickinson S. Miller has nearly completed a dissertation upon categories.

Mr. E. A. Kirkpatrick is at work upon a book which is now well under way.

DEPARTMENT OF MODERN LANGUAGES.

The work in this department has been under the charge of Mr. Camille Ried throughout the year. The object of instruction in this department has been to give to those scientific students who desired it further practical knowledge of modern languages that they might better command the literature of their own special departments. Work in scientific philology, or in the study of literature as such, has not been attempted.

During the past year there have been no beginners in any language.

In German the work has been as follows:

Class I. Whitney's Grammer "Bilderbuch ohne Bilder" by Anderson; "Germelshausen" by Fr. Gertäcker; "Höher als die Kirche" by Von Hillern; and exercises in conversation.

Class II. Goethe's Italienische Reise, read with a special view to construction.

Class III. Read Wundt's "Grundzüge der physiologische Psychologie" 300 pages in class and the rest in private. Special attention was given here to syntax and the exact meaning of technical terms in physiology, anatomy etc., which were treated critically as to both origin and use.

In French Class I. read Oger's edition of Voltaire's "Seicle de Louis XIV" special attention being given to pronounciation.

Class II. read "La psychologie de l' attention" "Le maladie de la personnalité" both by Professor Th. Ribot.

HISTORY AND BUILDINGS.

Clark University was founded by the munificence of a native of Worcester County, whose plans, conceived more than twenty years ago, have gradually grown with his fortune.

He has done so with the strong and express desire that the highest possible academic standards be here forever maintained; that special opportunities and inducements be offered to research; that to this end the instructors be not over-burdened with teaching or examinations; that all available experience, both of older countries and our own, be freely utilized, and that new measures, even innovations, if really helpful to the highest needs of modern science and culture be no less freely adopted; in fine, that the opportunities of a new foundation in this land and age be diligently explored and improved.

He has chosen Worcester as the seat of the new foundation after mature deliberation—first;

Because its location is central among the best colleges of the East, and by supplementing rather than duplicating their work, he hopes to advance all their interests and to secure their good will and active support, that, together, further steps may be taken in the development of superior education in New England; and secondly;

Because he believes the culture of this city will ensure

that enlightened public opinion indispensable in maintaining these educational standards at their highest; and that its wealth will ensure the perpetual increase of revenue required by the rapid progress of science.

As the first positive step towards the realization of his long-formed plans, MR. CLARK invited the following gentlemen to constitute with himself a Board of Trustees:

STEPHEN SALISBURY,

A. B., Harvard, 1856, Universities of Paris and Berlin, 1856-58; Harvard Law School, 1859-61; President Antiquarian Society since 1887.

CHARLES DEVENS,

A. B., Harvard, 1838; Harvard Law School, 1840; Major-General, 1862; Judge of Supreme Court, 1857; United States Attorney General, 1877-81; LL. D. Columbia and Harvard, 1877; Judge Supreme Court since 1881.

GEORGE F. HOAR,

A. B., Harvard, 1846; Harvard Law School, 1849; United States House of Representatives, 1868-76; United States Senate since 1876; LL. D., William and Mary, Amherst, Harvard and Yale.

WILLIAM W. RICE,

A. B., Bowdoin, 1846; admitted to Bar, 1854; United States House of Representatives; 1876-86; LL. D., Bowdoin, 1886.

* JOSEPH SARGENT,

A. B., Harvard, 1834; M. D., Harvard, 1837; London and Paris Hospitals, 1838-40.

JOHN D. WASHBURN,

A. B., Harvard, 1853; Harvard Law School, 1856; Representative, 1876-79; State Senate, 1887; United States Minister to Switzerland, 1889.

FRANK P. GOULDING,

A. B., Dartmouth, 1863; Harvard Law School, 1866; City Solicitor since 1881.

GEORGE SWAN,

A. B., Amherst, 1847; admitted to Bar, 1851; Member of Worcester School Board since 1879; Chairman of High School Committee.

To fill the vacancy in the Board caused by the death of Dr. Joseph Sargent, the unanimous choice of the Trustees, at a meeting held October 2d, 1889, fell upon

EDWARD COWLES,

A. B., Dartmouth, 1859; M. D., Dartmouth, 1862, and College of Physicians

* Died October 12, 1888.

and Surgeons, N. Y., 1863; Assistant Surgeon U. S. A., 1863–72; Resident Physician and Superintendent Boston City Hospital, 1872–79; Med. Supt. McLean Asylum, Somerville, Mass., since 1879; Professor of Mental Diseases Dartmouth Med. School, since 1885; Clinical Instructor in Mental Disease, Harvard Medical School, since 1888.

A petition for a charter was at once made by this board, and granted by the Legislature Jan. 18, 1887.

The following is

THE ACT OF INCORPORATION.

CHAPTER 133.

COMMONWEALTH OF MASSACHUSETTS, IN THE YEAR ONE THOUSAND EIGHT HUNDRED AND EIGHTY-SEVEN. AN ACT TO INCORPORATE THE TRUSTEES OF CLARK UNIVERSITY IN WORCESTER.

Be it enacted by the Senate and House of Representatives in General Court assembled, and by authority of the same, as follows:

SECTION 1. Jonas G. Clark, Stephen Salisbury, Charles Devens, George F. Hoar, William W. Rice, Joseph Sargent, John D. Washburn, Frank P. Goulding and George Swan, all of the city of Worcester, in the Commonwealth of Massachusetts, and their successors, are hereby made a corporation by the name of the Trustees of Clark University, to be located in said Worcester, for the purpose of establishing and maintaining in said city of Worcester an institution for the promotion of education, and investigation in science, literature and art, to be called Clark University.

SECTION 2. Said corporation may receive and hold real or personal estate, by gift, grant, devise, bequest or otherwise, for the purpose aforesaid, and shall have all the rights, privileges, immunities and powers, including

the conferring of degrees, which similar incorporated institutions have in this Commonwealth.

SECTION 3. Said corporation shall have the power to organize said University in all its departments, to manage and control the same, to appoint its officers, who shall not be members of said corporation, and to fix their compensation and their tenure of office; and said corporation may provide for the appointment of an advisory board, and for election by the Alumni of said University to fill any vacancies in said board.

SECTION 4. The number of the members of said corporation shall not be less than seven nor more than nine, and any vacancy therein may be filled by the remaining members at a meeting duly called and notified therefore; and when any member thereof shall, by reason of infirmity or otherwise, become incapable, in the judgement of the remaining members, of discharging the duties of his office, or shall neglect or refuse to perform the same, he may be removed and another be elected to fill his place, by the remaining members, at a meeting duly called and notified for that purpose.

SECTION 5. This Act shall take effect upon its passage.

House of Representatives, March 30, 1887, Passed to be Enacted.

CHARLES J. NOYES, *Speaker.*

Senate, March 31, 1887, Passed to be Enacted.

HALSEY J. BOARDMAN, *President.*

During the previous five years, Mr. Clark had gradually acquired a tract of land comprising over eight

acres, located on Main Street, about a mile from the heart of the city, with additional tracts near by. This land has considerable elevation above that part of the city, is a watershed sloping to the south-east, ensuring sanitary excellence and a wide and picturesque view. A park reservation of about 25 acres, directly opposite, has been set apart by the city, and named University Park.

CENTRAL BUILDING.

Plans for a main building were submitted to the Board by Mr. Clark, which were approved, and its erection was at once begun. The corner-stone was laid with impressive ceremonies, Oct. 22, 1887. The building is plain, substantial and well appointed, 204x114 feet, four stories high and five in the centre, with superior facilities for heating, lighting and ventilation, and has been constructed of brick and granite, and finished throughout in oak.

The following year a Chemical Building was planned and erected.

The foundations of another department building are laid.

On April 3d, 1888, G. Stanley Hall, then a professor at the Johns Hopkins University, was invited to the presidency. The official letter conveying this invitation contained the following well-considered and significant expression of the spirit animating the Trustees:

"They desire to impose on you no trammels; they have no friends for whom they wish to provide at the expense of the interests of the institution; no pet theories

to press upon you in derogation of your judgment; no sectarian tests to apply; no guarantees to require, save such as are implied by your acceptance of this trust. Their single desire is to fit men for the highest duties of life, and to that end, that this institution, in whatever branches of sound learning it may find itself engaged, may be a leader and a light."

This invitation was accepted May 1st, and the President was at once granted one year's leave of absence, with full salary, to visit universities in Europe. This year was diligently improved in gathering educational literature and collecting information and advice from leading authorities, a report of which will probably be made later. Upon his return in April, 1889, it was unanimously voted to begin the University in five scientific departments, as follows: Mathematics, Physics, Chemistry, Biology and Psychology. It was also determined that the work of these departments should be, for the present, advanced or post-graduate work only.

In accordance with these provisions, instructors were engaged, announcements issued, apparatus and books ordered, and rooms equipped. Formal opening exercises were held on Oct. 22,* in the large hall of the University, and the work of instruction in these departments was at once begun.

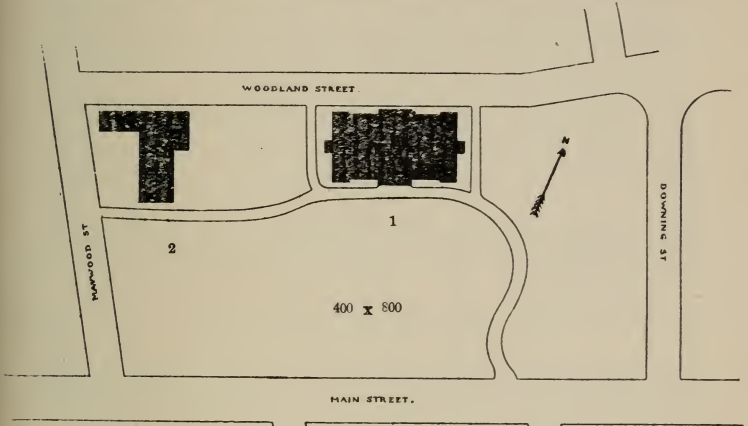
DESCRIPTION OF BUILDINGS.

THE BUILDINGS are situated on a lawn of about eight acres with a frontage of 800 feet on Main street.

*The proceedings and addresses on this occasion are printed in a pamphlet entitled, "Opening Exercises of Clark University."

CLARK
UNIVERSITY

The location is high and the building is placed on the most elevated point of ground and commands an extensive view over the city and the surrounding hills. The location of the buildings is shown in the following plan.



1. Central Building. 2. Chemical Building.

The elevations of the Central Building and the floors of both are shown in the accompanying sketches.

Central Building.

The plans of the first and central building of the University are the result of long observation and study and careful consultation with the leaders of education in both Europe and America. Its characteristic features are utility and solidity, and the aim has been to produce a model structure in all that relates to light, ventilation, sanitary arrangements, and acoustic properties.

The structure shows a general front of three stories high above the solid granite base of seventeen feet and the middle section has a fourth story which carries a clock tower. At each end is a projection in the shape of a tower rising one story above the

general level of the roof. The base story which at the front is entirely above the ground is laid up in bold rock faced granite, ashler capped with a cut granite water table belt. The main entrance is recessed under a granite archway 11 feet wide and 14 feet high. Over this is a granite balcony. Three special entrances to the right of the main entrance, one to the left leading into the gymnasium, and still another in the east end tower have been provided. The entrance from Woodland street is in all respects similar to that on the Main street side. Above the water table the building is constructed of Philadelphia pressed brick, with granite trimmings. Three large granite tablets on the central part of the front bear the inscription CLARK UNIVERSITY 1887.

The extreme length of the building is 204½ feet, and its extreme width 114 feet. The height of the rooms are 17-16-14-12 feet in the clear.

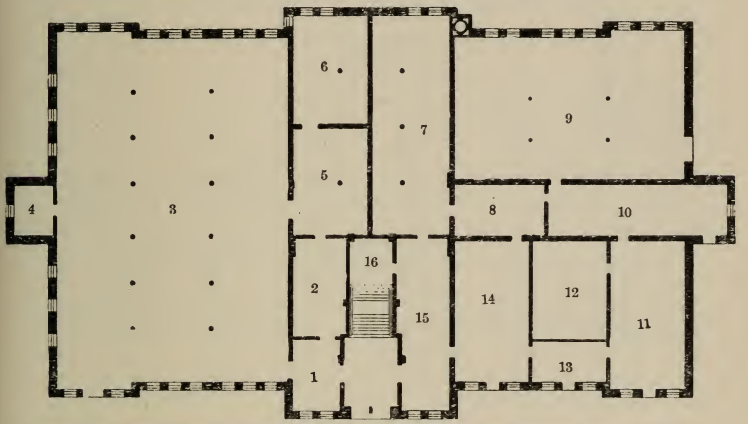
WALLS, FLOORS AND FINISH.

The outer walls are two feet thick, and are of brick laid hollow the plaster being laid directly on the brick with no outside furring. A large portion of the partitions are entirely of brick The building has thus been constructed with a general view to fire resisting qualities although it is not claimed to be fire proof. There is a stand pipe at each end of the building with hose attached in the hall of each story. Where the partition walls are not of brick two independent partitions with an air chamber between divide the several lecture rooms for the purpose of deadening the sound, and are further improved by felting and asbestos linings. The same precautions have been taken with the floors, two thicknesses of deadening paper having been used in addition to the air spaces of 14 inches between the floors and the ceilings. The inner walls of the first floor are of pressed brick throughout the building. The doors, casings and wainscotings (5½ feet high throughout both the main halls and 3½ feet in all the other rooms) are of Indiana white oak. All the floors are of rock maple and black birch. All water closets, bowls and basins above the first floor are located in the towers at either end of the

building. The plumbing throughout is of the best style of modern workmanship.

ROOMS.

In the south, the first floor is the gymnasium (No. 3). This room is 96 feet in length, 64 feet in width and 17 feet in height. It has a special entrance in the south-west corner and it also connects with the main entrance. Adjoining the gymnasium



Scale, one inch=about 53 feet. Dimensions of Building, 204 x 114 feet.

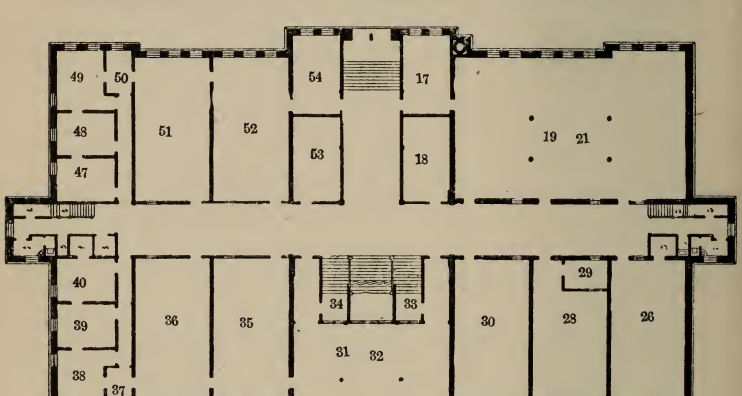
FIRST FLOOR.

are two large rooms (Nos. 5 and 6.) To the right of the main entrance are five connecting rooms (Nos. 11 to 15.) One of these (15) is fitted up as a machine shop and the other four are special research rooms of the Physics department. Back of these rooms are the boiler room, (No. 9) engine and dynamo room (No. 7), and a room for the storage battery cells (No. 8).

The Main street entrance opens into a vestibule 14 x 17 feet, from which the stairway, 12 feet wide, leads to the main corridors of the upper stories. Directly opposite the head of the stairs is a corridor leading to the Woodland street entrance. On either side of this corridor are two store rooms each 13 x 24 feet. (Nos. 18–53).

Running longitudinally through the middle of the building is a corridor 14 feet wide, terminating in the towers at either end, which have stairways leading to the several stories. In the central section of the Main street front is the library (Nos. 31 and 32) 32 x 44 feet, and adjoining it the reading room (No. 35) and the faculty room (No. 36), each of which are 21 x 40 feet.

In the southwest end of this floor are the rooms (Nos. 37 to 40)



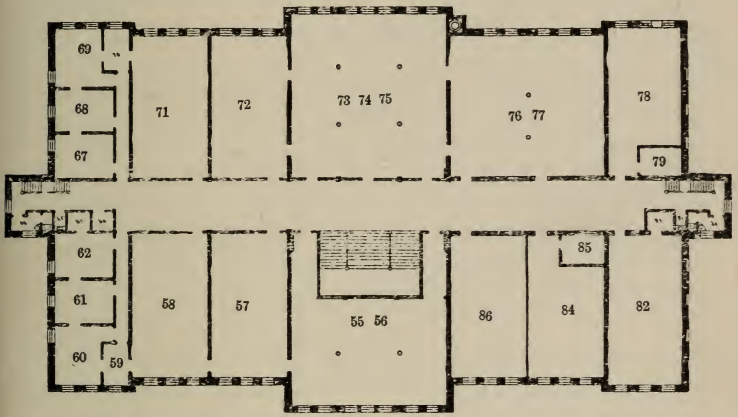
SECOND FLOOR.

of the President, and the University Office. The Anthropological (Nos. 47–48), Psycho Physical (No. 51) and Neurological (No. 52) laboratories with their adjoining rooms for the instructors in these departments.

In the northeast are three rooms (Nos. 26–28–30), each 21 x 40, devoted to the purposes of the Physics department, one (No. 30) as a lecture room, the other two as private research rooms. There is also a large lecture hall (Nos. 19–21) 40 x 65 feet. The rooms on this floor are 14 feet high.

The third story is reached by a double flight of stairs, each section, 8 feet wide, leading to a landing 8 x 30 feet, and from this by a single flight, 12 feet wide, to the floor.

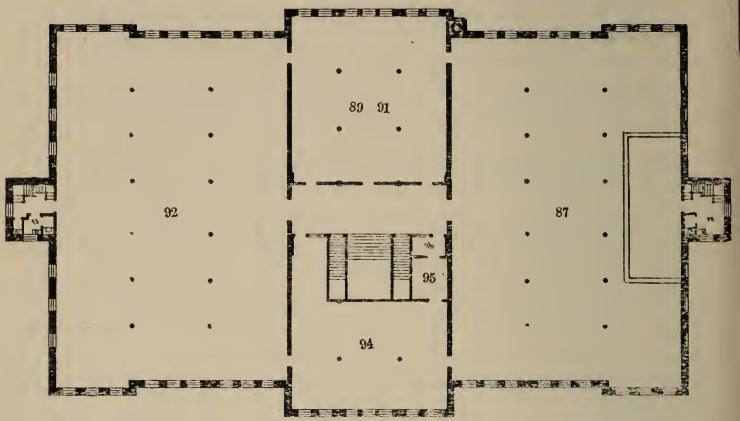
This floor has the longitudinal corridor as below, and eight private rooms (Nos. 59 to 62 and 67 to 70) for the instructors at the west end. It also contains the Mathematical (Nos. 57–58) and Biological (Nos. 71–72) lecture rooms, the Morphological (Nos. 73–74–75) and Anatomical (Nos. 76–77) laboratories, (each of



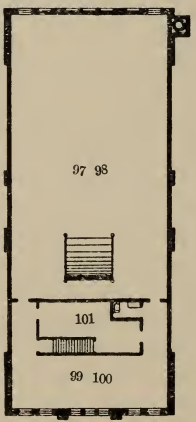
THIRD FLOOR.

which is 44 feet square), a large lecture room (Nos. 55–56) immediately over and corresponding in size to the library on the floor below, a room, (No. 78) 21 x 40, fitted up as a Meteorological laboratory and several other offices and rooms.

At each end of the fourth floor is a large lecture hall 65 x 100 feet and 16 feet in the clear (Nos. 87–92). The two rooms on the north and south of this floor are fitted up, that on the north (Nos. 89 to 91) for Animal Physiology and that on the south (Nos. 94 to 96) for Human Physiology. Each of these laboratories is 32 x 44 feet.



FOURTH FLOOR.



FIFTH FLOOR.

The central portion of the building is carried up another story and is reached by two flights of stairs leading into a hall or gal-

lery (Nos. 97–98) 44 x 80 feet and with a dome light 12 x 40. Adjoining this hall are two smaller rooms, from which a flight of stairs leads up to two large and well-lighted store-rooms.

HEATING.

The boiler-room, where the steam heating apparatus is located, is arched over with brick and iron girders, making the room absolutely fire proof. The low pressure gravity system is employed, and all pipes are graded away from the boilers, so that the condensed steam is carried by its own weight. The two large boilers are of 110 horse-power each. They are 6 x 17 feet in size, with 16 feet tubes, 3½ inches in diameter. The boilers stand side by side, and are connected at the top by a drum. They are so arranged as to be run together or separately. The apparatus is divided into five systems, so that by means of valves in the distributing pipes heat can be cut off at the boilers from any given section of the building. Each system can be used separately or all can be run together, so that any one or more of the five sections of the building can be heated independently.

From the drum, which connects the two boilers, a 10-inch distributing pipe runs, and from this are two branch pipes, one eight inches and the other six inches in diameter. The six inch pipe supplies heat for the northerly end of the building, and the eight inch pipe, with its various branches, heats the central and southerly sections. From this pipe and at right angles with it are 6 inch branches running from the front to the rear, and then along the sides of the building. From it also extend 2½ inch branches through the center of the building. At various points along these pipes risers run to the floors above, and from each riser steam is taken off for radiators on each floor. At the bottom of each riser and at every low point is a drip pipe connecting with the return pipes on the ground, which convey the water back to the boiler to be again converted into steam. This method of carrying off the water prevents the disagreeable snapping, common to steam apparatus, caused by the steam being forced against condensed water in the pipes.

A double system of heating has been adopted, running the pipes to every room, so that the chill can be taken off the building very

quickly. Thirty air chambers are placed on the first floor, where cold air is brought directly over the stacks, and fresh air is carried all over the building. No one of the air chambers connects with more than one room. The air, after entering the chambers, strikes perforated discs, through which it is distributed evenly through the radiators.

LIGHTING.

Following the models of such institutions both in this country and in Europe, every room in the building receives only a direct light. All cross lights are studiously avoided, the windows and seats all being arranged so that the light will be received at the back or the side of the students. The number, size and arrangement of the windows give an abundance of direct light to every room in the building.

There are in all about 250 windows with large paned and first quality German sheet glass and all are carried to the ceiling so that the greatest amount of light is obtained for the given surface of glass. The matter of obtaining a direct light has been accomplished without detriment to the general design of the building.

VENTILATION.

The fact that all the windows reach to the ceiling aids of course to secure good ventilation and there is besides a ventilating flue to every four feet of wall.

The entire first floor is ventilated by the flue, $2x2\frac{1}{2}$ feet, which surrounds the steam chimney, and into which are openings on each floor.

The flat roofs are elevated about three feet above the ceilings, leaving an air space inside for the purpose of giving a draft of air to guard against variations of temperature. This space is ventilated by apparatus in the wall which can be opened or closed from the rooms below.

A summary statement of the size of the rooms may be made as follows:

The MAIN BUILDING contains

3	rooms	65x100 feet
1	"	44x80 "
2	"	40x65 "
2	"	44x44 "
3	"	31x32 "
14	"	21x40 "

and also six-five smaller rooms making a total of 90 rooms and 101 numbers.

CHEMICAL BUILDING.

The chemical building is constructed throughout of brick. The main body of the building has three stories, its south-western wing has two stories, each 22 feet in the clear. Its facilities for heating and ventilation are substantially the same as those of the main building. The outer walls are 2 feet in thickness, and the partition walls from 12 to 16 inches. All partitions are of brick, so that the building is nearly fire-proof. There are two main laboratories, 24 x 58, and 22 feet high.

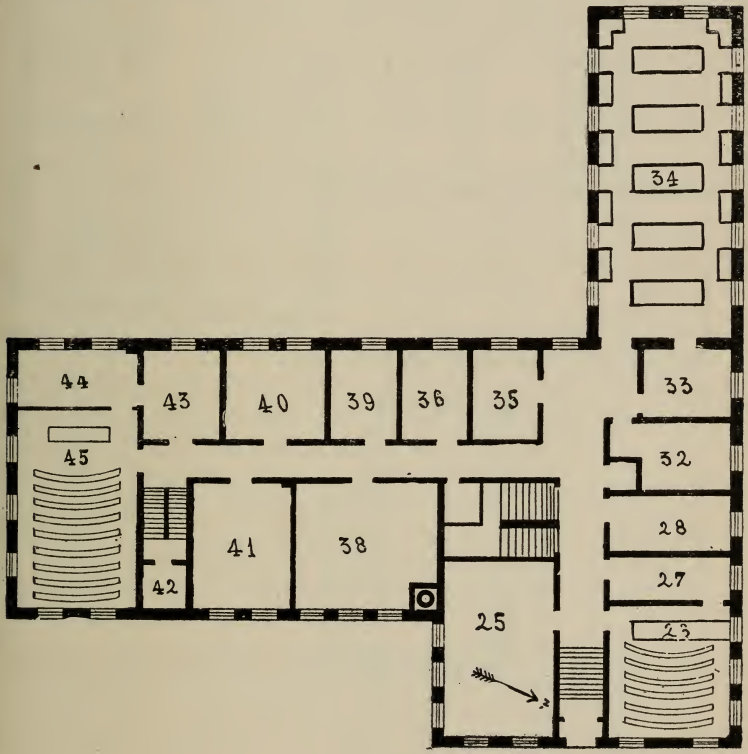
FIRST FLOOR.

17	Furnace Room.	23	Crystallization Room.
10	Boiler Room.	16	Steam Room.
3	Store Room.	8	Coal.

Dimensions of Building, 134' 8" x 135 feet. Scale, 1 inch = about 34.10 feet.

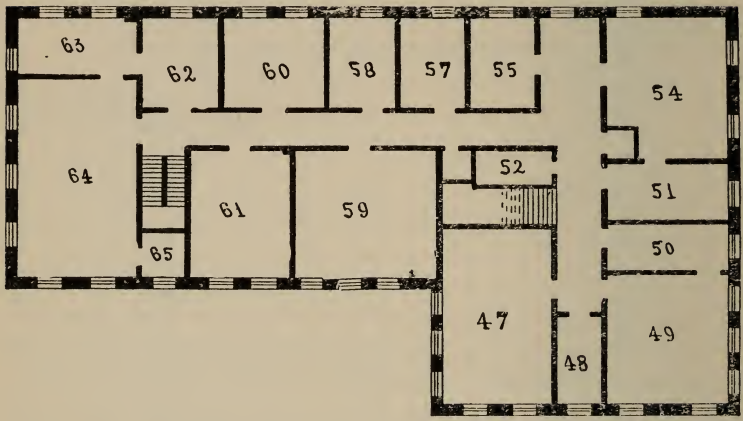
SECOND FLOOR.

26 Lecture Room.
28 Balance Room.
32–33 Store Rooms.
34 Main Laboratory.
35 Combustion Room.
39 Crystallography—Private Room of Dr. Williams.
41 Physical Chemistry Room—Private Room of Dr. Loeb.
45 Lecture Room.

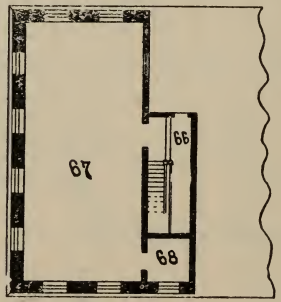


THIRD FLOOR.

47 Professor's Private Room. 51 Microscopy and Spectral Analysis—Private Room of Dr. Muthmann. 52 Dark Room. 54 Private Laboratory of Dr. Nef. 61 Chemical Library.



FOURTH FLOOR.



The CHEMICAL LABORATORY contains

2	rooms	24x58	feet			22	feet	high
4	"	22x47	"	14	to 16	"	"	
3	"	26x32	"	"		"	"	
3	"	20x32	"	"		"	"	
4	"	22x24	"	"		"	"	
3	"	18x32	"	"		"	"	
3	"	16x18	"	"		"	"	
12	"	14x16	"	"		"	"	

and others varying from 12x16 and 10x22 to 6x6, making a total of 68 rooms.

REGULATIONS.

ENACTED BY THE BOARD OF TRUSTEES APRIL 11TH, 1890.

1. All requisitions for apparatus and books must be made through the University office upon printed blanks provided for that purpose, and, except in the case of Docents, signed by a member of the staff.

2. So far as possible orders for only the kind and amount of apparatus certain to be used during the year shall be placed, nothing shall be ordered for future years, and apparatus for research shall take precedence over that for teaching and illustration only.

3. A book shall be kept for each department containing a complete list of apparatus and supplies with itemized cost. With the aid of this book a complete inventory of the stock shall be made once a year and whenever else the President shall direct.

4. Requistions for repairs, furniture, plumbing and work about the buildings, must be made in writing and with detail and must be approved by the Building or Finance Committee or such person or persons as they

may authorize. When once thus passed upon no change involving additional expense can be made in the requisitions without the consent of the Finance Committee.

5. No unappropriated rooms, and no part of the University grounds, shall be used for any purpose, and appropriated rooms shall not be used for other purposes than the stated University work for which they were intended, without previous permission from the office.

6. Unless for special reasons, absence of Instructors from their stated exercises or from town for two consecutive week days in term time, should be announced at the Office, and for longer absence permission should be obtained beforehand.

7. The Trustees desire that no Instructor, Docent or Fellow shall enter upon other engagements outside his proper work in the University of a kind or amount likely to lessen his full efficiency for science within the University.

PUBLICATIONS CONNECTED WITH THE UNIVERSITY.

I.—The Journal of Morphology.

This Journal was commenced in September, 1887, and is edited by Professor C. O. Whitman, with the co-operation of Edward Phelps Allis, Jr., of Milwaukee. From two to four numbers a year are issued, in crown octavo, of 150 to 200 pages each, with from five to ten lithographic plates. Vol. I (two numbers), $6.00; Vol. II (three numbers), $9.00; single numbers, $3.50.

II.—The American Journal of Psychology.

This Journal was commenced in November, 1887, and is edited by Dr. G. Stanley Hall. Each volume contains four numbers of about 150 pages each. Besides original articles, about half its space is devoted to careful digests of the important literature in its field. Price, $5.00 per volume; single numbers, $1.50.

III.—The First Official Announcement was issued May 23d, 1889.

The Addresses and Exercises at the opening of the University on October 2d, 1889.

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